One-off Export Events

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Abstract

An astonishing 33% of all firm-product-destination export spells in Danish data turn out to be isolated single-month one-off export transactions (observed once in a 49-month window). On average, for an export-active firm, one-off events generate 17% of foreign sales. These patterns cannot be explained by the lumpiness of trade (e.g., seasonal shipments), nor do they sit well with available trade models. To reconcile theory with the data, we introduce passive (i.e., buyer-side driven) exporting. Our empirical investigation establishes novel stylized facts on firm and destination characteristics associated with one-off exporting.

JEL: F14, F12, L10, D40

Keywords: Passive exporting, proactive exporting, export duration, temporary trade, monthly data, transactions data, firm-level data, heterogeneous firms.

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1 Introduction

Temporary or discontinued export spells are an important stylized fact of international economics. The present paper uncovers a new layer in the data, namely the surprising prevalence of isolated one-off export transactions. Combining annual and monthly transactions data, we examine a total of 220,998 firm-product-destination export spells from a balanced sample of manufacturing firms in Denmark. We find that 72,807 of these spells (i.e., 33%) are in fact one-off export events: a single month of export transactions observed in the center month of a 49-month window of non-exporting.[1] Such one-off export events will appear as year-long export relations in the annualized data sets that are typically available to researchers. Averaging across export-active firms, such one-off events make up 43% of export spells and account for 17% of export sales. Moreover, these events are associated with smaller shipments and are found across all product categories. Flipping the data and examining 980,755 firm-product-country of origin import spells, the central observation is repeated. Nearly 40% of import spells turn out to be isolated single-month one-off events.

Despite of the presumably widespread presence of one-off transactions in trade data, they are not reflected in international trade theory. While temporary trade, i.e., discontinued export relationships – but not specifically one-off events – has been successfully embedded, for example by including demand uncertainty, learning or productivity shocks (e.g., Besedes and Prusa, 2006a,b; Lawless, 2009; Albornoz et al., 2012; Eaton et al., 2011; Békés and Muraközy, 2012; Aeberhardt et al., 2014), the prevalence of one-off exporting in the data leaves much to be explained.

The available economic theories on exporting and export duration have in common, that they focus on the proactive exporting behavior of firms. The theoretical and empirical analysis in the present paper, however, stresses the importance and coexistence of passive exporting. The intuition is simple: Foreign customers can approach domestic firms that have chosen not to export proactively. Such episodes will surely be present in the data. As a result, there will be passive as well as proactive exporting. While the seller side of an export relation and hence proactive exporting has been the central focus in economics, other disciplines have highlighted the buyer side as equally important. Export development models or exporter stages models (e.g., Johanson and Vahlne, 1977) in international business and international mar-

[1] These results are qualitatively highly robust to alternative filtering rules, for example, excluding capital goods, enforcing a 121-month (10 years) window of non-exporting, or altering the aggregation level of the commodity classification. The share of firm-product-destination export spells that are one-off spells varies between 26% to 42% for the various permutations of the filtering rule; see Section 2.

keting research have for a long time distinguished passive (reactive) from proactive exporters. In particular, foreign customers, export/import agents, or wholesalers who place unsolicited export orders, rank high in explaining export initiation; see the seminal synthesis of Bilkey (1978).[2] Of particular interest to the present paper are the ample cases of passive exporting associated with one-off events, such as intermediaries that need to resolve an out-of-stock issue, wholesalers who continuously alter their product portfolio, trial and error import demand or single customer demand driven by a perfect match product variety.

Against this backdrop, the present paper proposes a simple extension of the Melitz (2003) model. We maintain the customary proactive export decision and capture temporary exporting by demand fluctuations. Firms disengage from proactive exporting once hit by a sufficiently weak demand realization. As a new feature, we introduce passive exporting. Even though a firm has – based on its realized vector of firm-specific parameters including productivity – decided to abstain from proactive exporting to a given destination, it may receive an unsolicited one-off export order from that market. In this case, the firm still has to decide whether or not to service the order.

The conceptual model arrives at a number of results on the selection of firms into different export modes and suggests a role of destination-specific characteristics for the prevalence of one-off exports. First, for any given destination proactive exporters are on average more productive (and larger) than passive exporters, which again are more productive than non-exporters. Second, for any given destination permanent exporters are on average more productive than temporary exporters. Third, destinations requiring higher market access costs (featuring larger fluctuations) will see more one-off (temporary) exporting. We match moments from the model to moments in the data to inform us on important but unobserved variables, such as the fixed costs of exporting proactively relative to the fixed costs of exporting passively and the implied probability of receiving unsolicited orders.

In the empirical section we establish novel stylized facts on one-off export events utilizing business account and trade data for the universe of Danish manufacturing firms, including monthly transactions data for the period 2001-2012. We find that one-off exporting is associated with lower productivity and smaller firm size; more-

[2]The international business and international marketing literature on passive versus proactive exporting is truly vast. For passive exporters one-off, small or discontinued orders are a frequent issue. As a matter of fact, the seminal work of Johanson and Vahlne (1977), developing the so-called Uppsala model, traces the irregular export activity of early stages explicitly to sporadic 'offers of demand' from abroad. In their bibliographic analysis of 50 years of International Business research into exporting, Leonidou et al. (2010) identify that studies dealing with proactive versus passive export stimuli feature prominently among 25 major research themes.

over, it is much more likely to occur for exports to faraway, low-income or unstable destinations.

The present paper makes two central contributions. First, our paper is the first to document the prevalence of very short isolated low-volume export spells: one-off export events. Second, we argue that an underlying explanation for the prevalence of one-off export events is passive exporting by firms. Hitherto, passive exporting has not been addressed in international economics. Since single-month one-off episodes are so widespread in the data, international economics ought to reflect the phenomenon. We show that both theoretically and empirically such passive exporting is associated with different firm and destination characteristics compared to longer lasting proactive exporting. In particular, our model illustrates that passive exporting can be included in the current workhorse model of heterogeneous firm trade.

These contributions have important implications: First, trade flows data must be interpreted more carefully. One-off export events will be masked as single-year export episodes in annual data, yet they might reflect rather different underlying factors, compared to longer-term export relations. Second, our paper shows that increased attention to the buyer side of the export relation is an important avenue for future research. Third, policy design needs to acknowledge the prevalence of one-off export events. Knowledge of the particular microstructure of exporting has implications for whether and which policies will trigger lasting export relationships. Export initiation through promotion programs might not always have a lasting effect, i.e., long-term monitoring of participating firms is essential. Moreover, trade facilitation should be tailored and differentiated when aiming at the export relations' seller or buyer side, respectively. Finally, promotion programs that aim at faraway and volatile markets might be particularly prone to triggering disappointing singular export events with little lasting impact.

Even though the present paper with its application of monthly transactions data at the firm-product-destination level is the first to pinpoint the prevalence of one-off export events, there are a number of important previous works.[3] Exemplary for the literature on the duration of export relationships are Besedes and Prusa (2006a, 2006b and 2011). These papers have – inter alia – pinpointed the role of destination market characteristics – a dimension we also explore in the current paper. Besedes

[3]Wagner (2016) provides a comprehensive survey of more than 150 published and unpublished empirical studies on exporting and importing based on transaction level data, including 9 studies using monthly data. None have dealt with the prevalence of one-off export events. Recently, Bernard et al. (2014) employ monthly Peruvian data to examine the bias in annual data stemming from partial year effects.

and Prusa (2006a, 2006b and 2011) deal with the issue of export duration based on country-pair-product level annual data, but not firm-product-destination level monthly data. Work by Lawless (2009) introduces the firm dimension into this literature and establishes a presence of rich entry and exit dynamics and variation in the number of markets a firm serves. Yet, Lawless (2009) focuses on the firm-destination export status in annual data. In contrast, monthly transaction data is employed in the lumpiness of trade literature, i.e., infrequent shipments due to seasonality, inventory management or per-shipment costs, e.g., Alessandria et al. (2010) and Hornok and Koren (2015). Our filtering definition based on a single transaction in a 4-year period purposefully separates one-off export events from lumpy trade.

The paper closest in spirit to the current work is perhaps Békés and Muraközy (2012) since they examine export spells at the firm-product-destination level. In fact the current paper applies the filtering mechanism proposed by Békés and Muraközy (2012), in order to distinguish between permanent export spells (defined as having durations of four years or longer) and temporary trade (spells up to three years). They find in annual Hungarian data that a large fraction of export spells are temporary, a finding that we replicate in the Danish data. Based on their findings Békés and Muraközy (2012) propose a model to explain the significant share of temporary trade spells by time-varying firm productivity combined with an endogenous choice of trade technology.[4] We go beyond previous work by exploiting monthly transaction data, which allows us to uncover the pervasiveness of one-off export events otherwise hidden in annual data. To reconcile existing theory with this new empirical phenomenon we propose a model extension capturing passive exporting.

The remainder of the paper is structured as follows. Section 2 gives a first look at the data and maps the prevalence of one-off exporting. Section 3 presents the conceptual model based on the Melitz (2003) model augmented with passive exporting and arriving at permanent, temporary and one-off exports. We use the model to guide our further empirical investigation in Section 4. We examine destination characteristics and firm characteristics associated with one-off exporting. Section 5 flips the data and reviews the composition of buyers that are involved in one-off import events. Section 6 concludes.

[4]More recently, Gullstrand and Persson (2015) formalize the idea that proactive exporting firms can endogenously decide on core and peripheral markets, depending on the sunk costs they spend. In peripheral markets firms will more readily exit from exporting. They confirm implications of the model with single-sector annual firm-product-destination data for Swedish food producers.

2 A first look at the data

2.1 Description of the data

Our data consist of Danish firm-level register data and business account information for the years 2001 to 2012 provided by Statistics Denmark. These data are merged with monthly destination- and commodity-specific export information for each firm which is available for the years 1993 to 2012.[5] Starting from the universe of all Danish firms, we exclude non-manufacturing firms and firms with missing sales or minimum sales in the sample period below DKK 100,000 (about USD 18,000). Firm-level export information by destination, commodity-type and year is obtained from the *External trade of Denmark* database which essentially covers all measurable export events of Danish firms.[6] In combination with monthly transaction data we are able to distinguish one-off exports events from temporary exports, i.e., short-run destination-specific export spells.

In order to study true permanent, temporary and one-off exporting, we construct a balanced firm sample for the years 2003 to 2010, excluding exiting and entering firms. Since monthly destination- and commodity-specific export information is available for all exporting firms since 1993, left truncation of export spells is no issue. To avoid right truncation, we must observe at least two full years in the data after an export spell has potentially ended. Since the last match between firm-level register data and monthly export transactions data is possible for the year 2012, our balanced sample ends with 2010.

The resulting sample consists of $n = 3132$ surviving firms, of which $n_X = 2993$ at some point over the period 2003 to 2010 export. For each firm we define export spells drawing on the respective export destination and two-digit Combined Nomenclature (CN) commodity classifications as reported in the firm-level *External trade of Denmark* database. To account for several changes in the commodity classification during our sample period (the CN is continuously updated), we apply the concordance scheme of Van Beveren et al. (2012) which builds on the methodology

[5]The reader should note, that we use the terms product and commodity synonymously, but prefer the term commodity when referring to data.

[6]For our analysis we exclude Danish exports to Greenland and the Faroe Islands which are autonomous destinations closely tied to Denmark and governed by special trade and reporting regulation. Furthermore, we consolidate a number of small export destinations that we consider to be closely connected politically or geographically with a larger entity. Examples in case are Gibraltar which although a British territory is consolidated with Spain or French Guiana and Reunion which are overseas departments and thus consolidated with France. The key point is that such a consolidation makes our definition of one-off exporting more conservative as several export spells are aggregated.

developed in Pierce and Schott (2012).[7]

Following the methodology proposed in Békés and Muraközy (2012), we start by classifying an export spell as permanent when the firm-commodity-destination-specific export activity takes place for more than three years in a row. Using our annual trade data for these steps circumvents the issues associated with the lumpiness of trade, i.e., we allow for trade interruptions within a year. Following the same logic, firm-commodity-destination-specific export events that only occur for up to three years in a row are defined as temporary.[8] Different from Békés and Muraközy (2012) export spells are not assessed at the 6-digit but at the 2-digit CN level. This makes our definition of termination of an export spell more conservative. Product switching in an established export destination that would count as a discontinued export relation at a finer disaggregation level is at the 2-digit level still counted as a continuing relation.

Going beyond existing research, we identify one-off export events in the data, i.e., we further differentiate temporary exports by using firm-commodity-destination monthly as opposed to yearly export information. We classify a firm-commodity-destination export episode as an one-off export event when we observe a single-month export transaction preceded and followed by 24 months of non-exporting, i.e., a 4-year window of non-exporting with a single transaction in the center month. This rule eliminates even the most extreme sporadic export patterns that are known from the lumpiness of trade literature (see e.g., Alessandria et al., 2010; Hornok and Koren, 2015), i.e., annual or seasonal shipments, and leaves us with true one-off export episodes. To be clear, these spell definitions purposefully ensure that a single-year export observation that is composed from two separate months of export transactions is still labeled as a temporary export spell. Similarly, an export spell that has only one month of transaction, can violate the filtering rule of 24 months of non-exporting before and after, but pass the filtering rule for a temporary spell, thus some temporary export spells will consist of only one month transaction, but do not qualify as one-off events.

[7] We start by concording exports to consistent CN codes. This already involves the aggregation of some 8-digit CN codes. As our analysis takes place at a higher aggregation level (6- and 2-digit), we further aggregate and develop efficient concordance tables which draw on trade data at the most aggregated CN level that is feasible. This way we can exploit export information even if the last digits of CN codes are not reported due to confidentiality restrictions. Note that all concording steps make our one-off export identification more conservative.

[8] Our monthly export data allows for alternative definitions of temporary exports by directly measuring the export spell length in months. However, due to the lumpiness of trade, export activities are frequently interrupted for several months, for instance due to a summer holiday break or inventory management and shipment constraints, resulting in extremely short export spells. Allowing for an up to 11 months pause between firm-commodity-destination export events would come close to the definition of permanent and temporary based on annual data.

2.2 One-off events in the data

Apart from balancing our panel, which will stack the deck against our finding of one-off events, we have maintained all the characteristics of the export data. Moreover, our data are still fully comparable to data sets used in previous research, i.e., allows us to distinguish permanent from temporary exports. In addition, we have added the monthly export transactions dimension which permits identification of one-off export episodes, which in annual data sets would appear as single year annual exports. Table 1 displays the surprising results of this exercise. Depending on the chosen product aggregation, 33% to 38% of all export spells are in fact one-off export events.

The commodity aggregation level is decisive for how readily an export spell is recorded as being terminated. The higher the aggregation level the lower must be the overall number of separately recorded export spells and the higher the proportion of permanent exports. This becomes clear from columns 2 and 5 in Table 1. Starting at the most disaggregated unconcorded 8-digit CN classification, we observe 509,586 firm-commodity-destination export spells in our sample of which only about 25% can be considered permanent. Moving to a higher aggregation level, say 6-digit CN, reduces the total number of separately recorded exports spells and raises the proportion of permanent ones. Reassuringly with respect to previous studies on temporary exports (e.g., Békés and Muraközy, 2012), concording CN codes has little effect for the proportion of temporary exports, at least at the 6-digit CN level.[9] Our preferred commodity aggregation level is the 2-digit concorded CN, since it allows for firms to alter and upgrade their exported product mix within continued trade relationships.[10] As reported in Table 1, we observe a total of 220,998 export spells at the CN 2-digit concorded level. If we were to solely rely on annual data, 152,004 export spells in our data would be classified as temporary. Yet, consulting monthly transaction data we find that in fact 72,807 of these spells are one-off export events. Thus, about 33% of all export spells in the data are in fact one-off, i.e., only occur in the center month of a 49-month period of otherwise non-exporting.

These are striking figures, more so as the applied filtering is on the conservative side, i.e., prone to identifying export spells as permanent. Still, to ensure the robustness of these figures we re-run the analysis, once excluding capital goods exports, once excluding exports of non-core products (i.e., excluding products that are not associated with the firms' 2-digit industry), and once by only considering

[9] At the 6-digit level CN and the Harmonised System of trade data are equivalent.

[10] For example consider an exporter of men's or boys' cotton shirts (CN 620520) that switches to exporting women's or girls' cotton shirts (CN 620630).

Table 1: **Firm-product-destination export spells**

	Total	Percentage out of total spells		
	# of spells	One-off	Temporary (excl. one-off)	Permanent
CN 8-digit unconcorded	509,586	38.33	36.65	25.02
CN 6-digit unconcorded	440,823	38.38	35.72	25.91
CN 6-digit concorded	417,518	37.92	35.65	26.43
CN 2-digit concorded	220,998	32.94	35.84	31.22
Robustness – CN 2-digit concorded				
Core products only	91,078	25.70	34.97	39.33
Excl. capital goods	191,227	32.99	35.93	31.07
Extra EU trade only	129,744	41.22	35.78	23.00
Extra EU w. threshold	108,756	41.68	35.33	22.99

Notes: Permanent: spells of 4 or more years; Temporary: spells of 3, 2 or 1 years; One-off: an isolated one-month-only export transaction in the center of a 49-month interval. Extra EU trade: exports to countries outside the European Union. See the main text for further details on the spell definitions and implemented product aggregations.

exports to countries outside the European Union (so called extra EU trade).[11] Excluding capital goods exports or non-core products are fairly extreme measures. For example, disregarding capital goods exports amounts to ignoring most export activity by capital goods producers. Similarly, excluding non-core exports means that many export spells for firms that in terms of their product mix span several industries are excluded. However, as is shown in the lower panel of Table 1, the data still feature sizable shares of one-off export events, i.e., 33% when excluding capital goods and 26% when excluding non-core product exports.

When looking at extra EU trade only, we find that the share of one-off export events moves to 41%, in turn implying that intra EU trade (i.e., exports to member countries of the European Union) has proportionally fewer one-off events. This gives a first indication that higher market access costs, say through higher tariffs, border related costs, distance or other institutional differences might matter for the frequency of one-off export events.

Finally, in Table 1 we also confirm the robustness of these figures with respect to official export declaration requirements. While firms may declare any export sales independent of size or value, they are legally forced to do so for transactions exceeding certain threshold values. For example, for sales outside the EU (extra EU) only shipments exceeding a value of DKK 7,500 (about USD 1,100) or a weight

[11] To identify capital goods exports, we draw on the correspondence between 8-digit CN and UNs Broad Economic Categories (BEC). To identify firms' core products, we utilize an efficient correspondence between CN and the 2-digit Statistical Classification of Products by Activity in the European Economic Community (CPA2008). Both original correspondence tables are available on Eurostat's RAMON classification server.

of 1000 kg have to be reported to the custom authorities. Rules for intra EU sales are more lax and have seen several changes in recent years.[12] However, regardless of legal reporting requirements the data features ample reporting of transactions that are below the reporting thresholds. The reason is, that firms get a VAT tax refund for sales to foreign customers. Since Denmark with a 25% VAT rate has one of the highest rates in the world, Danish firms have a strong incentive to declare all their foreign sales.

It is instructive to check the effect of enforcing the official reporting threshold on the factual export observations in the data. Obviously, implementing the legal threshold may artificially create export exit and entry in export relations that truly are continuous but hover around the threshold. We can check for the size of this effect. Looking at extra EU (member countries in 2012) sales, we can compare the full data (Extra EU trade only) with a version of the data that enforces the reporting threshold (Extra EU with threshold). The lower panel of Table 1 shows that roughly 15% of recorded extra EU export spells are below the reporting threshold, i.e., 20,988 (= 129,744 - 108,756) spells. Comforting for our analysis, the share of one-off, temporary and permanent spells is unaffected by including or excluding the reporting threshold condition. Throughout the paper we use the full data of all reported transactions.

Summarizing, although the proportion of one-off export events obviously varies with the aggregation level and the type of exports considered, this first look at the data shows that even with the most conservative definition of one-off events the phenomenon does account for at least a quarter of the export spells in the data.

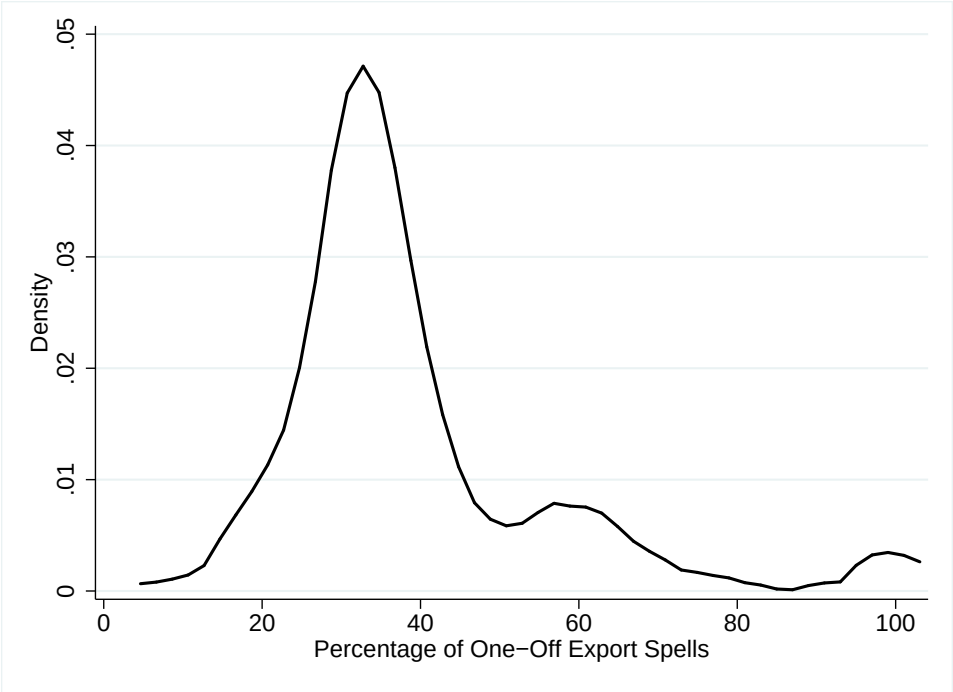
2.3 Presence across commodities

While the omission of capital goods in Table 1 did not change the prevalence of one-off events, it is still instructive to ask, whether the phenomenon of one-off exporting is confined to certain commodities; say products with low-frequency exporting such as large equipment, ships or other specific capital goods. A closer look at the data, however, reveals that one-off exporting activities take place across the board. To show this, Figure 1 depicts the estimated density function of the percentage of one-off export spells in all export spells across all commodities (2-digit concorded CN). While the percentage of one-off export spells substantially varies between

[12]For intra EU trade, the threshold that obliges a firm to report export sales depends on the firm's total export sales (annual). In the sample period of our data the threshold varied between DKK 2.5 and 5 million DKK (about USD 370,000 to 740,000). In addition, a monthly export volume of intra EU exports below DKK 3,000 (about USD 444) or 1000 kg may be reported as "other goods".

commodities, the mean is 39% and the bottom and top deciles are 25% and 61%, respectively. Thus, one-off exporting is not confined to particular commodities.

Figure 1: **Density of one-off exporting across commodities**



Note: Density of the percentage share of one-off export spells in all export spells across CN 2-digit concorded commodities.

2.4 Patterns by year, window of non-exporting and duration

An immediate question is whether one-off exporting is a phenomenon that over time has become more widespread, possibly due to advances in information and communication technology that potentially make unsolicited export orders more likely. Table 2 shows the number of newly started firm-destination-commodity export spells by year (2003-2010) and the respective percentages of permanent, temporary and one-off export events at the 2-digit concorded CN commodity classification. While we see some fluctuation over time, the share of one-off events hovers around 40% (49-month interval) with no apparent time trend. Thus, potentially reduced information and search costs that the advent of e-commerce has brought about have – if at all – affected one-off as well as temporary and permanent exporting in a similar fashion.

Focusing on new export spells makes it possible to illustrate the effect of applying larger windows of non-exporting in the definition of one-off events. Obviously,

Table 2: **New firm-product-destination export spells by year**

Year	Total # new spells	Perm.	Percentage our of total spells			
			49-month interval		121-month interval	
			One-off	Temporary (excl. one-off)	One-off	Temporary (excl. one-off)
2003	22,170	18.94	44.02	37.04		
2004	21,037	22.60	39.82	37.58		
2005	20,017	21.16	40.22	38.62		
2006	24,439	20.16	40.99	38.85	28.24	51.60
2007	23,200	19.63	41.38	38.99	28.05	52.32
2008	22,451	19.11	42.21	38.68		
2009	21,067	21.31	40.24	38.45		
2010	23,960	29.14	37.76	33.10		

Notes: Permanent: spells of 4 or more years; Temporary: spells of 3, 2 or 1 years; One-off: an isolated one-month-only export transaction in the center of a 49/121 months interval. See the main text for details on the spell definitions.

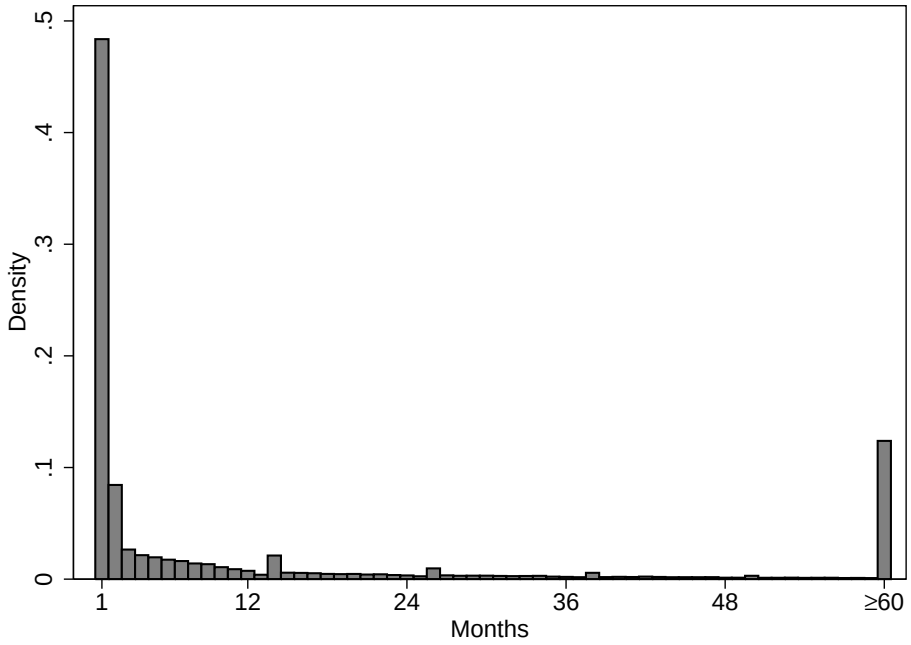
shortening or extending the 49-month window of observation will increase and decrease the number of export episodes that are identified as one-off. To check this effect, we apply the strictest definition of one-off export events that is feasible given the time dimension of our data: one single-month export transaction preceded by 60 months of non-exporting and followed by 60 months of non-exporting. Thus, in this 121-month definition a firm-product-destination export spell is identified as an one-off event only if it is taking place in the center month of a 10-year period of non-exporting. To avoid left and right truncation, this reduces our balanced sample to the years 2006 and 2007. Even for this extreme filtering rule, 28% of newly started export spells turn out to be one-off events.

To confirm that one-off events are a phenomenon of their own, it is instructive to ask if the frequency of such events really is different from the frequency of spells of, say 3 months length. In order to avoid issues of truncation, this question must be answered when focusing on newly started firm-destination-commodity export spells. Considering all newly started spells in the years 2003 and 2007, it is possible to examine the length (from first to last shipment month in a given spell) for at least 5 years. This allows for interruptions in exporting and seasonal shipment patterns.

Figure 2 depicts the density plot of export spell duration in months.[13] Single-month export relations stand out, i.e. spells with only one month of transaction

[13]Note, that spells with a total spell length of between 26 and 36 months in principle can be either permanent or temporary spells, since they can span either 3 or 4 calender years. Similarly, a subset of temporary spells has only one shipment, but violates the filtering rule of 24 months of non-exporting before and after the observation. Hence, not all the observations with a spell length of one month displayed in Figure 2 are included in our definition of one-off events. Accordingly, a more lenient filtering rule would increase the number of spells labeled as one-off events.

Figure 2: **Spell length in months, density plot**



Notes: Spell length for all export spells that are newly started between 2003-2007. Spell length is measured as the number of months from the first to the last observed month of transaction within an export spell.

clearly dominate the picture. Overall, the subsequent development displays a rather even density, obviously decaying as influenced by the termination of export relations.

2.5 The size of one-off shipments

Despite the commonness of one-off export spells in the data and accordingly their central role at the firm level, they matter much less in terms of total export volume. Out of the total exports sales in our data just 0.65% are due to one-off events. Clearly, permanent export spells will always dominate in terms of volume, however there are two additional effects that could be present. First, firm size and one-off exporting might be related; this is a prospect we examine in detail in Section 4.3. Second, the actual shipment size of one-off exports could be small compared to other export modes. Comparing the volumes (value) of one-off export events against those of permanent and temporary exports, we find exactly this difference.

We compare the average monthly shipment values (i.e., the order size) of newly started export spells (in their first year) for one-off, temporary and permanent export modes. Obviously, the monthly shipment value of a new one-off spell enters directly, while for new temporary and new permanent export spells several monthly

shipments may have taken place in the start-up phase (the first year) of the export relation. Accordingly, we divide first year sales by the number of shipment months in that year. Moreover, to facilitate comparison we consider values for a given product in a given destination. Figure 3 depicts the density functions of the relative average shipment size (value) by destination and commodity. Relative, because we normalized the average shipment value of a certain spell type by the sum of the average shipment values of all three export spell types (for a given product in a given destination). Thus, these are comparable export relationships, apart from the fact that some of them continue (at least with a second shipment month), while the one-off events are export relations that are not repeated.

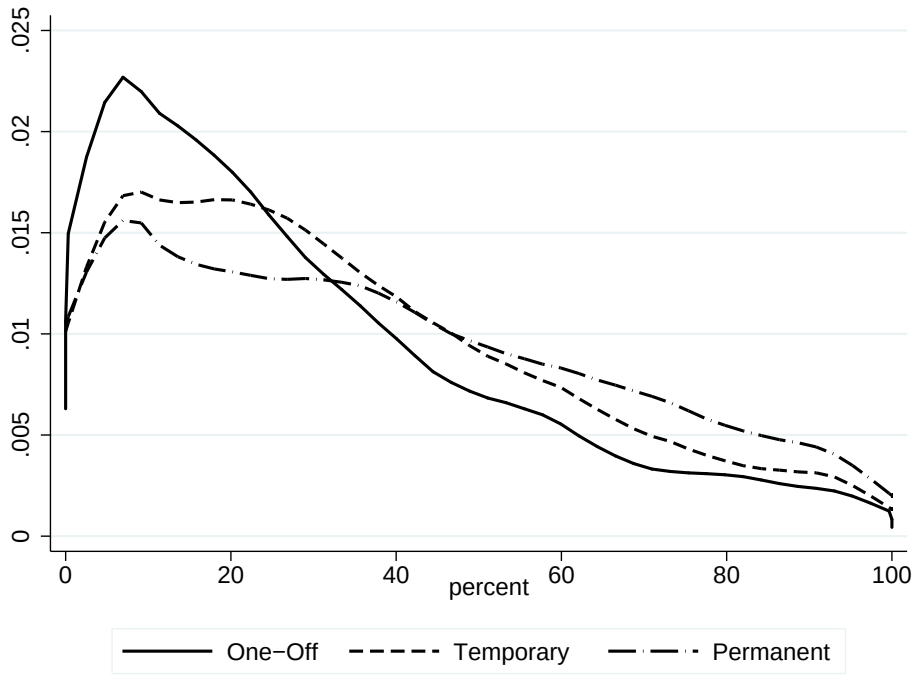
The means of the relative average destination-commodity-specific shipment size distributions are 29%, 34% and 38% for one-off, temporary and permanent export spells, respectively. Moreover, the density function for one-off export shipments clearly lies to the left of the ones for temporary and permanent exports. That is, the mass of one-off average shipment values at the low end of the distribution is considerably larger than that of temporary and permanent exports. Differences between the density functions of temporary and permanent exports are somewhat less pronounced, still for temporary exports the mass of the distribution is to the left of that of permanent exports. The visual inspection is confirmed by Kolmogorov-Smirnov tests of stochastic dominance of the corresponding cumulative distribution functions with error probabilities of far less than 1%.

2.6 What to make of this?

To sum up: First descriptives of the data have disclosed, that one-off export events at the firm-product-destination level are a frequent occurrence in trade relationships. They account for 26% to 38% of export spells, depending on the chosen level of commodity aggregation and the window of non-exporting applied in the filtering. One-off exporting takes place across all commodity groups, and the frequency of such events displays no time trend. Finally, shipment size of one-off events is significantly smaller than the shipment size of temporary and permanent export spells, even when comparing first year average monthly shipments.

These observations suggest that one-off exporting is a phenomenon in its own right. We argue that the mechanisms driving the prevalence of one-off export events must be different from those of proactive exporting usually featured in models of firms' international trade. In particular, we suspect that firms in addition to proactive exporting also experience passive exporting, for example, by responding to unsolicited orders from abroad. This may help explain the high frequency of

Figure 3: **Density of relative first-year average shipment volume by spell type**



Notes: Relative average shipment is calculated as the average monthly shipment size by destination and commodity of a spell type divided by the sum of the average monthly shipment size of all three types to that destination and commodity. Kolmogorov-Smirnov tests for CDF, One-Off < Temporary/Permanent: 0.1129, p=0.00 / 0.1664, p=0.00; Kolmogorov-Smirnov tests for CDF, Temporary < Permanent: 0.0758, p=0.00.

one-off exporting in the data.

Obviously, in the data other drivers of short and very short export relations will be present as well. The literature on export duration operates – inter alia – with a 'testing the waters' hypothesis to explain short proactive export episodes. Namely, firms have uncertainty about actual foreign demand or exporting costs. Models that include such features take their starting point by realizing that exports at the firm level are relationship-specific and that exporters might learn favorable or unfavorable things about the counterpart in the relation during the early transactions, e.g., Rauch and Watson (2003), Eaton et al. (2011), Albornoz et al. (2012) and Aeberhardt et al. (2014).[14]

[14]It is instructive to consider the amount of disappointing export relations that are implied if one-off export events in the data were solely caused by 'testing the waters'-type episodes. The figures from Table 2 show that approximately 40% of newly started spells turn out to be one-off events, i.e. a fairly high proportion of disappointing market opportunities. Furthermore, it is hard to accept that 17% (see Section 4) of a firm's export volume (averaged across firms) and associated export efforts are directed to proactively unlocking new export markets which, ex-post, turn out to be infeasible.

All in all, the view that a sizable share of export activity may in fact be passive exporting, i.e., responding to buyer-generated one-off demand, seems plausible. In fact passive exporting has been emphasized in the export development models and exporter stages models starting with Johanson and Vahlne (1977) and features prominently already in the synthesis of Bilkey (1978). Based on case studies and survey-based methods the international business and international marketing literature has developed the concept of passive (reactive) exporting during almost 50 years (see the reviews of Leonidou et al., 2007, 2010). For example the meta study of Leonidou et al. (2007, p. 751) concludes: "*Of all the motives to export, the most common is the receipt of an unsolicited order from a customer abroad (...).*" Our reading of the literature suggests that passive exporting exhibits discontinued singular one-off episodes, for example, when the initiator is a single customer or a foreign wholesaler resolving a temporary out-of-stock issue or retailers with a continuously changing product portfolio.

Naturally, the possibility of passive exporting does not replace the proactive exporting mode that is customary pictured in current trade theories. On the contrary, our model in Section 3 shows that proactive export modes and passive one-off exporting can be simultaneously included in the workhorse model of heterogenous firms trade.

3 A conceptual model of proactive and passive exporting

Consider a standard heterogeneous-firms trade framework of the Melitz (2003) type. Prior to entry, a firm i invests in a R&D activity which results in a blueprint for a firm-specific variety and a random vector of firm-specific parameters $\gamma_i = (\varphi_i, F_i, \tau_i, F_{x,i}, F_{m,i}, z_i, H_i(\rho))$ where φ_i is productivity, F_i is fixed production costs, τ_i is a vector of destination-specific iceberg trade costs. As a new distinction we introduce two types of fixed costs associated with export sales. First, $F_{x,i}$ is a vector of destination-specific fixed export costs other than marketing costs. Such costs capture for example product adaption or dealing with customs declarations and red tape at home. Any exporter must endure these costs, independent of the export mode. Second, $F_{m,i}$ is a vector of destination-specific marketing costs. Such costs capture for example costs associated with accessing a distribution network or reaching customers abroad. The size of these costs will in part depend on destination market characteristics and will – as becomes clear later – be associated with proactive entry into an export market. Finally, as will be elaborated below, z_i and

$H_i(\rho)$ reflect the probability and distribution of the order size associated with unsolicited export orders. We assume that the firms' stochastic parameters are drawn independent from each other. In what follows, we only focus on equilibria where all types of export activity coexist.[15] Note that the assumed cost structure implies that firms' decisions to enter each of the potential export markets are independent of each other.[16]

Consider firm i with productivity φ_i and its export decision regarding export destination d at time t. The firm may serve the market proactively which requires the firm to pay both the fixed costs of exporting $F^d_{x,i}$ and the fixed costs of marketing $F^d_{m,i}$. The profits from this export mode read

$$\pi^d_{i,t,x-pro} = B^d_t \varphi_i^{\sigma-1} \left(\tau^d_i\right)^{1-\sigma} - F^d_{x,i} - F^d_{m,i} \tag{1}$$

where B^d_t is a destination-specific and time-varying demand component and $\sigma > 1$ is the elasticity of substitution between any two goods.[17] In particular, the time changing B^d_t allows us to capture the idea that proactive exporters may start or discontinue export spells depending on changing demand conditions, such that our specification allows for permanent and temporary proactive exporters. This feature mirrors the formalizations in Békés and Muraközy (2012) and Gullstrand and Persson (2015), albeit their specifications build on different mechanisms. In Békés and Muraközy (2012) a central driver is time changing firm productivity, where temporary exporters are those that stop exporting after having received a negative shock to their productivity. Gullstrand and Persson (2015) model the option value of entering an export destination, and the uncertainty of future returns.

Changing demand, i.e., the model mechanism we employ, can be viewed as the summation of various events that change exporting conditions, such as payment risks, taste changes, exchange rate movements and business cycle developments.[18]

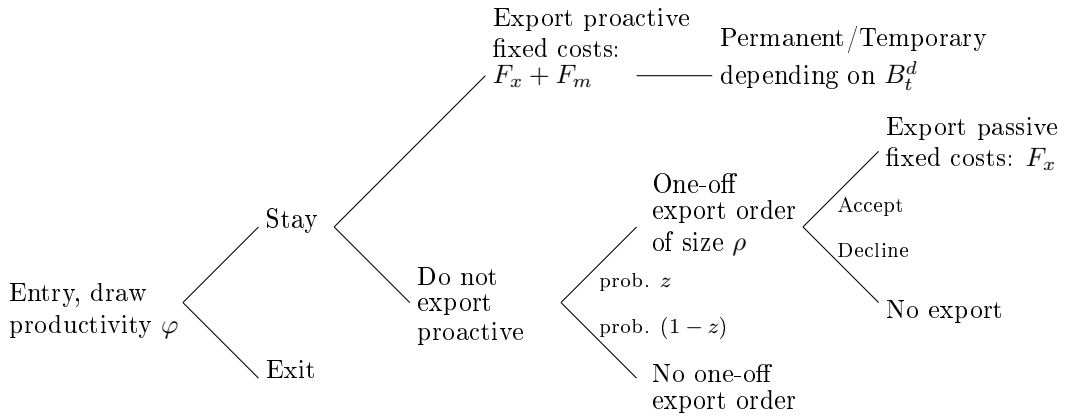
[15] This implies certain assumptions for the support of the parameter distributions and corresponds in essence to the partitioning condition in Melitz (2003).

[16] At the loss of generality we could impose more structure on the relations of the stochastic parameters, such that for example hierarchies of market entry or similar stylized facts could be captured, see Eaton et al. (2011).

[17] The functional form of the profit expression comes from an underlying CES demand structure. Note that although B^d_t is endogenous in general equilibrium, it is exogenous to the individual monopolistic firm.

[18] Obviously, changes in demand could also stem from a changing competitive environment, where new firms take customer shares from incumbent firms, see Schröder and Sørensen (2012) for a dynamic version of a Meltiz (2003) model along those lines.

Figure 4: **Schematic illustration of the model**



3.1 Introducing passive exporting

In addition to the proactive export mode giving access to the foreign market, there is a chance of passive exporting. We embed theories on passive exporting from the international business and international marketing literature (briefly introduced in Section 2.6) into our conceptual model in the following way: we assume that a customer from market d may approach firm i (not exporting proactively to market d[19]) and place unsolicited one-off export orders. This occurs with probability $z_i^d \in (0,1)$ which we assume to be exogenous from the firm's perspective. We assume that firms when receiving such external-to-the-firm generated orders only access the fraction $\rho_{i,t}^d$ of the consumers they would reach through the proactive export mode. Further, we assume $\rho_{i,t}^d \in (0,1)$ is a stochastic variable with a known distribution, $H_i^d(\rho)$, but the realization is unknown when the firm decides whether to engage in proactive exporting.[20] This captures the idea that buyer-driven passive exporting only represents one or a few consumers, compared to the number of consumers reached when the firm engages in proactive exporting with a complete marketing/distribution network at cost $F_{m,i}^d$. The firm still has to decide if it wants to service such one-off orders, since it faces the fixed costs of exporting $F_{x,i}^d$ although it does not incur the costs of marketing the product, $F_{m,i}^d$.

The profits from passive exporting read $\rho_{i,t}^d B_t^d \varphi_i^{\sigma-1} \left(\tau_i^d\right)^{1-\sigma} - F_{x,i}^d$. A firm only

[19]We thus assume that the two export modes to a given destination and at a given point in time are mutually exclusive.

[20]Note that $\rho_{i,t}^d$ could alternatively be interpreted to capture the situation that "rents" are transferred to the foreign agent responsible for facilitating the one-off trade relation, e.g., double mark-up pricing to the local wholesaler. Similarly, $\rho_{i,t}^d$ could represent that passive exporting is more likely to be associated with bargaining over the price (buyer power). Note, that we implicitly assume that foreigners from country d will not place unsolicited orders with firms that have established proactive marketing presence in country d.

services such a one-off foreign order if it earns positive profits from doing so. Positive profits occur once the fraction of consumers served in an unsolicited order is above the threshold defined by $\hat{\rho}_{i,t}^{d} \equiv \frac{F_{x,i}^{d}}{B_t^d \varphi_i^{\sigma-1} \left(\tau_i^d\right)^{1-\sigma}}$. The expected flow profits from passive exports to destination d thus become

$$\pi_{i,t,x-pas}^{d} = z_i^d \int_{\hat{\rho}_{i,t}^{d}}^{1} \left(\rho B_t^d \varphi_i^{\sigma-1} \left(\tau_i^d\right)^{1-\sigma} - F_{x,i}^{d} \right) dH_i^d\left(\rho\right). \tag{2}$$

Given that firms choose export status with the aim of maximizing expected profits, the above framework already generates a number of insights: A firm is ceteris paribus more likely to pick the passive export mode when its marketing costs, likelihood of receiving one-off export orders, and size of one-off orders are large. To see this, note that in (2) expected flow profits from passive exporting increase in the parameters z_i^d and $\rho_{i,t}^d$ and that in (1) flow profits from proactive exporting decrease in $F_{m,i}^d$. The impact of fixed and variable export costs and the demand aggregator are less straightforward as they affect profits from both export modes and the consumer share threshold $\hat{\rho}_{i,t}^{d}$.

3.2 Implications

Consider first how firms select into export status and export mode. Despite the fairly general formulation and without any additional structure on the model, we can make the following observations:

$$\frac{\partial \pi_{i,t,x-pro}^{d}}{\partial \varphi_i^{\sigma-1}} = B_t^d \left(\tau_i^d\right)^{1-\sigma} > \frac{\partial \pi_{i,t,x-pas}^{d}}{\partial \varphi_i^{\sigma-1}} = B_t^d \left(\tau_i^d\right)^{1-\sigma} z_i^d \int_{\hat{\rho}_{i,t}^{d}}^{1} \rho dH_i^d\left(\rho\right) > 0, \tag{3}$$

and

$$\frac{\partial \hat{\rho}_{i,t}^{d}}{\partial \varphi_i} < 0. \tag{4}$$

The inequalities in (3) state that in any given export destination flow profits from exporting increase with productivity, i.e., only sufficiently productive firms will export (irrespective of mode). In fact, the minimum required productivity level to find it profitable to service an unsolicited order with a consumer share of ρ is defined by

$$\varphi_{i,t,x-pas}^{d*} \equiv \tau_i^d \left(\frac{F_{x,i}^{d}}{\rho B_t^d} \right)^{\frac{1}{\sigma-1}}. \tag{5}$$

Moreover, it follows from (3) that expected profits from proactive exporting increase faster with productivity than expected profits from reacting on one-off ex-

port orders. Hence, when a firm is sufficiently productive, it chooses the proactive export mode despite the larger fixed costs of doing so. Accordingly, there exists a productivity threshold $\varphi_{i,t,x-pro}^{d*}$ such that firm i exports to market d proactive at time t if and only if $\varphi_i > \varphi_{i,t,x-pro}^{d*}$, where $\varphi_{i,t,x-pro}^{d*}$ is defined by $\pi_{i,t,x-pro}^{d}\left(\varphi_{i,t,x-pro}^{d*}\right) \equiv \pi_{i,t,x-pas}^{d}\left(\varphi_{i,t,x-pro}^{d*}\right)$ and equals (in implicit form as $\hat{\rho}_{i,t}^{d}$ depends on $\varphi_{i,t,x-pro}^{d*}$)

$$\varphi_{i,t,x-pro}^{d*} \equiv \tau_i^d \left(\frac{F_{m,i}^d + F_{x,i}^d \left(1 - z_i^d \int_{\hat{\rho}_{i,t}^{n,k}}^{1} dH_i^d(\rho)\right)}{B_t^d \left(1 - z_i^d \int_{\hat{\rho}_{i,t}^{d}}^{1} \rho dH_i^d(\rho)\right)} \right)^{\frac{1}{\sigma-1}}. \tag{6}$$

Assuming that B_t^d time fluctuates around a stable mean of B^d such that $B_t^d = B^d \varepsilon_t$, where ε_t is an iid stochastic variable, it follows that the productivity threshold for proactive exporting $\varphi_{i,t,x-pro}^{d*}$, see (6), fluctuates around a stable mean of $\varphi_{i,x-pro}^{d*}$ such that $\varphi_{i,t,x-pro}^{d*} = \varphi_{i,x-pro}^{d*}(\varepsilon_t)^{-\frac{1}{\sigma-1}}$. Hence, firms with larger $\varphi_i - \varphi_{i,x-pro}^{d*}$ gaps are more likely to survive as proactive exporters in market d when B_t^d fluctuates.

The observation in (4) states that the required fraction of consumers ($\rho_{i,t}^d$) that is needed for the firm to profit from responding to unsolicited one-off export orders from a given export destination, decreases with productivity, i.e., the probability of exporting passively to destination d conditional on not exporting proactive to destination d is thus increasing in productivity.[21] The model includes firm heterogeneity in several dimensions ensuring (the empirical relevant) overlap in, e.g., productivity distributions of exporters and non-exporters, and passive and proactive exporters to a given destination. Still, since productivity, φ_i, is assumed to be independent of other sources of exogenous firm heterogeneity (and therefore independent also of functions of such exogenous heterogeneity, e.g., $\varphi_{i,t,x-pro}^{d*}$), one can derive clear-cut 'on average' findings regarding firms' selection into export mode and export status at a given destination, conditional on productivity. In short, given the independence assumption the ceteris paribus findings above generalize to the population of firms:

Implication 1. *Firms passively servicing one-off export orders from market d are on average more productive and larger than firms not exporting to market d.*

Implication 2. *Proactive exporters to market d are on average more productive and larger than passive exporters servicing one-off export orders from market d.*

Implication 3. *Among the proactive exporters on market d prior to time t, it applies that for any reduction in market demand B_t^d at time t, the firms continuing*

[21] We have that $\Pr\left(\rho > \hat{\rho}_{i,t}^d\right) = 1 - H_i^d\left(\hat{\rho}_{i,t}^d\right)$ and thus $\frac{\partial \Pr\left(\rho > \hat{\rho}_{i,t}^d\right)}{\partial \varphi_i} = -h_i^d\left(\hat{\rho}_{i,t}^d\right) \frac{\partial \hat{\rho}_{i,t}^d}{\partial \varphi_i} > 0$ cf. (4).

to export (permanent exporters) are on average more productive and larger than those firms discontinuing their export activity (temporary exporters).

Implication 1 extends the standard ranking of exporters versus pure domestic firms to the case of passive exporting. The underlying mechanism – focusing on the dimension of firm productivity alone – is that the presence of fixed export costs, $F_{x,i}^d$, forces low productivity firms to reject one-off orders. Implication 2 establishes a new ranking between proactive and passive exporters. Finally, Implication 3 provides a ranking of permanent and temporary exporters and mirrors the ranking derived by Békés and Muraközy (2012) in their model with firm-specific productivity shocks.

The extended framework maintains all the well known properties of the Melitz (2003) model as well as standard – empirical relevant – extensions, such as asymmetric markets. For example, in the above formulation more productive firms export (on average) to more markets. However, albeit tempting and intuitively compelling, one cannot directly infer an unambiguous relation between firm-level exporter productivity and the firm's degree of passive exporting from this model. For example, the relation may be non-monotone as the number of markets served and the number of goods produced are endogenous and depend on productivity. With higher productivity it becomes more likely that a firm serves a given market via proactive exporting. However, at the same time the higher productivity makes one-off export orders more profitable and may in turn increase the number of markets served by the passive export mode. To arrive at unambiguous predictions we would need to impose significantly more structure on the model concerning the distribution of the attractiveness (and thus hierarchy) of the various markets (see e.g., Lawless, 2009, or Eaton et al., 2011) and the firm-level product ranges. The more general model from above and Implications 1 to 3 deal with the firm-product-destination level. These findings guide our empirical analysis when we consider how firm-level aggregates of export status and export modes across products and destinations correlate with firm-level productivity.

In order to address the question of how the importance of passive exporting differs across destinations, we impose additional structure on the model. In particular, we assume that there is no exogenous heterogeneity across firms (except for productivity and the realization of the random arrival of unsolicited one-off export orders), but maintain heterogeneity across destinations.[22] Moreover, we assume that productivity is Pareto distributed with shape parameter $k > \sigma - 1$. These assumptions enable us to derive the event share ($\hat{\Psi}^d$, i.e., the fraction of total ex-

[22]To be specific, we assume that $F_i^d = F^d, \tau_i^d = \tau^d$, $F_{m,i}^d = F_m^d$, $F_{x,i}^d = F_x^d$, $\rho_i^d = \rho^d$, $z_i^d = z^d$ for all i. We thus assume that $H_i^d(\rho) = H^d(\rho)$ and that $H^d(\rho)$ is degenerate at ρ^d for all i and d.

port relations with market d being passive at a given point in time) and the volume share ($\hat{\Upsilon}^d$, i.e., the fraction of total export volume to market d being passive at a given point in time) of passive exports in total exports in each destination at any point in time.[23]

$$\hat{\Psi}^d = \left[1 + \frac{1}{z^d} \frac{\left(\frac{\rho^d}{1-z^d\rho^d}\left(1 - z^d + \frac{F_m^d}{F_x^d}\right)\right)^{-\frac{k}{\sigma-1}}}{1 - \left(\frac{\rho^d}{1-z^d\rho^d}\left(1 - z^d + \frac{F_m^d}{F_x^d}\right)\right)^{-\frac{k}{\sigma-1}}}\right]^{-1} \tag{7}$$

$$\hat{\Upsilon}^d = \left[1 + \frac{1}{z^d\rho^d} \frac{\left(\frac{\rho^d}{1-z^d\rho^d}\left(1 - z^d + \frac{F_m^d}{F_x^d}\right)\right)^{1-\frac{k}{\sigma-1}}}{1 - \left(\frac{\rho^d}{1-z^d\rho^d}\left(1 - z^d + \frac{F_m^d}{F_x^d}\right)\right)^{1-\frac{k}{\sigma-1}}}\right]^{-1}. \tag{8}$$

We can state:

Implication 4. *The event share and the volume share of passive exporting ($\hat{\Psi}^d$ and $\hat{\Upsilon}^d$) in market d increase in the ratio of marketing costs to fixed export costs ($\frac{F_m^d}{F_x^d}$), in the probability of receiving an order (z^d), and in the size of the orders (ρ^d) in market d.*

Higher marketing costs, higher probability of receiving orders passively, and a larger size of such orders all make passive exporting more attractive relative to proactive exporting, and this is directly reflected in the event and volume shares of passive exporting.

3.3 Illustrative calibration: Insights on the unobserved drivers of passive exporting

In a final step we implement a simplified version of the above model (including a back-of-the-envelope calibration) and match it to two moments in the data. This allows us to illustrate the parameter range and size of effects needed for such a model to generate patterns that actually resemble an extent of one-off exporting found in the data. Moreover, this allows us to cast light on the magnitude of the new variables that we have introduced in order to capture passive exporting. Namely, the probability of receiving a random unsolicited one-off export order (probability z), the difference between fixed costs of proactive ($F_m + F_x$) and passive (F_x) exporting and the difference in market reach between the two export modes (customer share

[23] These event-based measures are different from the perspective on spells in Sections 2 and 4. Both expressions are derived in Appendix A.

ρ). While these three variables drive the distinction between proactive and passive exporting, they are never directly observed in transaction data.

Far from all the theoretically feasible parameter combinations are compatible with the patterns observed in the data. For example, a very large F_m combined with a ρ near 1 would more or less eliminate proactive exporting as a meaningful export strategy for sufficiently high levels of z – a pattern at odds with the data. Calibrating the model and matching it to moments in the data, allows us to narrow down the permissable parameter range for the drivers of passive exporting.

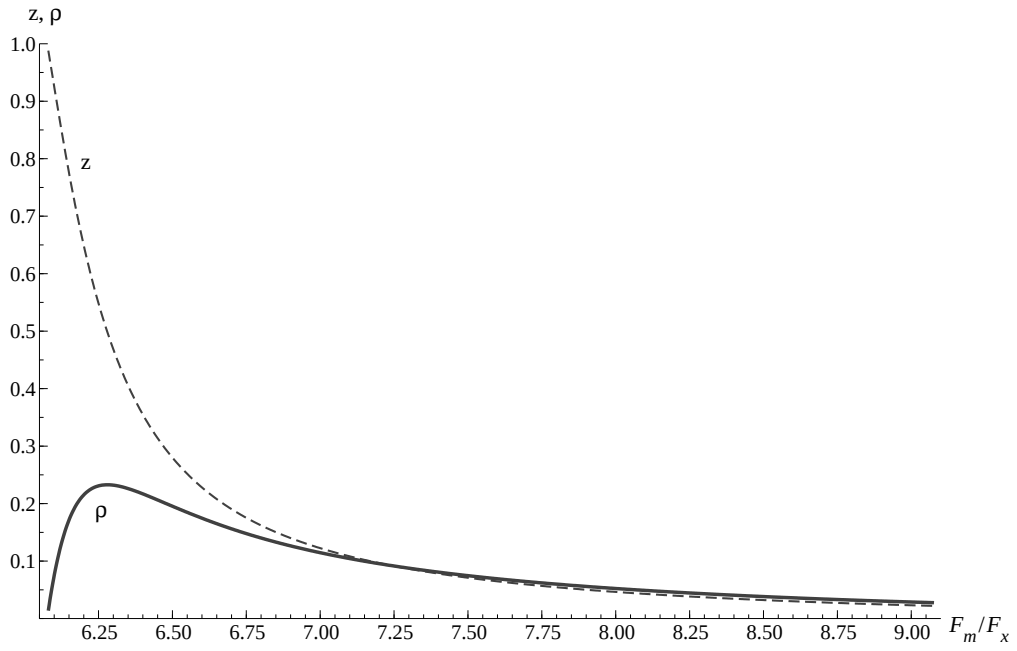
We match the event share and the volume share of passive exports from the model to the corresponding shares in the data. Imposing symmetry across destinations implies that the equations for the two shares derived in (7) and (8) – see also Appendix A – translate directly when aggregating across destinations. Simply omitting superscript d arrives at the new expressions.[24] We equate the theoretical event share ($\hat{\Psi}$) with the share of one-off (passive) events in total events (passive and proactive) across the period 2003-2010 (the figure is 13.2%). In the same fashion we equate the theoretical volume share ($\hat{\Upsilon}$) with the fraction of total one-off (passive) export sales in total export sales across the period 2003-2010 (the figure is 0.65%). To calibrate the model we impose $k = 4.25$ and $\sigma = 4$ implying that $\frac{k}{\sigma-1} = 1.42$, cf. Melitz and Redding (2015). Note that in this calibration a time period is a year and z should thus be interpreted as the probability of receiving an export order from a given market within a year.

It becomes clear, that with three unknown parameters z, ρ and $\frac{F_m}{F_x}$ and two moments, there is one degree of freedom. Thus we can derive combinations of z, ρ and $\frac{F_m}{F_x}$ that are able to solve the model. For example, any given value of $\frac{F_m}{F_x}$ implies some specific value of z and ρ, yet z and ρ are at the same time bound between zero and 1. Figure 5 shows the results: we plot z and ρ for all values of $\frac{F_m}{F_x}$ that are consistent with the two moment conditions. It turns out, that the range of $\frac{F_m}{F_x}$ where the model is consistent with data spans from around 6 to 15. If we extended the range of $\frac{F_m}{F_x}$ in Figure 5, we see that both z and ρ approach zero monotonically as $\frac{F_m}{F_x}$ moves towards the upper bound. Even though this exercise is a purely illustrative back-of-the-envelope calculation, it reveals a number of important insights. First, the differences between the fixed costs associated with proactive and passive exporting must be substantial in order to be compatible with the moments from the data (minimum factor 7).[25] Thus, accessing a market through proactive exports, say with an own distribution network, is 7 to 16 times more expensive in terms of

[24] Note that these are event-based shares and thus different from the spell-based shares in Section 4.

[25] Note that $\frac{F_m}{F_x} > 6 \Rightarrow \frac{F_m+F_x}{F_x} > 7$

Figure 5: **The permissible parameter range identified by calibration**



fixed costs, than accessing the same market in response to an unsolicited one-off order. Second, the order sizes (customer shares, ρ) from passive exports must be substantially smaller than the sales achieved through proactive exporting (a maximum of 23%) to allow the model to be consistent. Thus, the calibrated version of the model implies that substantial fixed costs savings but small scale sales are associated with passive exporting. Third, inspection of Figure 5 shows that the model disciplined by the calibrated values and the two moments from data has important implications for the combinations of z, ρ and F_m/F_x. In particular, the probability of receiving unsolicited one-off orders when markets have high market access costs (large F_m/F_x) must be very low. In addition, the feasible sales (customer share) in such a situation must be very small, too. On the other extreme, if markets are relatively easy to reach through proactive exports (low F_m/F_x), the probability of unsolicited orders must be substantial, while the order size is still constraint to only a fraction of the sales reached through proactive exports.

4 Empirical analysis

The above formalization of passive and proactive exporting gives three directions for empirical investigation. First, destination characteristics (that will affect the

market-specific costs of exporting, Implication 4) must be examined – this also mirrors the approach followed in the export duration literature (e.g., Besedes and Prusa, 2006a and 2011; Lawless, 2009). Second, given that our data includes the firm dimension, we are able to address the prevalence of one-off exporting at the firm level. Third, we provide evidence on the characteristics, i.e., productivity and size ranking (Implications 1 – 3) of firms that are more heavily engaged in one-off exporting, or temporary and permanent exporting respectively.

4.1 Destination-level analysis

Given our classification of export spells as one-off or otherwise (see Section 2 for a full description of the data and spell definitions), we can assess the geographic distribution and analyze destination-specific determinants of one-off exports. We construct destination-specific indices for the relative importance of one-off exports based on their share (Ψ) in all export spells towards a given destination or their respective export volume share (Υ):[26]

$$\Psi^d = \frac{\sum_{s \in S_d \cap S_{re}} 1}{\sum_{s \in S_d} 1} \quad , \quad \Upsilon^d = \frac{\sum_{s \in S_d \cap S_{re}} ex_s}{\sum_{s \in S_d} ex_s} \ , \tag{9}$$

with s representing a firm-commodity-destination-specific export spell, S_{re} the set of all one-off export spells and S_d the set of all export spells belonging to destination d. The volume of a specific export spell is denoted as ex_s.

Figure 6 depicts the geographic distribution of one-off export events. We map the destination-specific share of one-off export spells Ψ^d for each of the 213 export destinations of Denmark. While for half of all export destinations the share of one-off export spells is equal or higher than 47.5%, it is particularly high for, e.g., parts of Central and South America, Africa, and isolated microstates such as Bhutan and The Federate States of Micronesia. The bottom and top deciles of Ψ^d are 17.5% and 73.5%, respectively. In comparison, Danish exports to countries in the European Union – Denmark's main trading partner – are much less likely to be one-off. Still, when aggregating $d \in EU15$ export spells the share of one-off exports is a surprising 18%.

Turning our attention to the role of one-off exports in the destination-specific export volume Υ^d, Figure 7 reveals that while one-off exports matter, for most destinations the importance of one-off exporting in terms of volume is much lower than the importance of one-off exporting in terms of the spell shares. Moreover, in

[26] Note that these measures are spell-based, opposed to event-based measures employed in the calibration exercise.

Figure 6: **The share of one-off export events in all export spells**

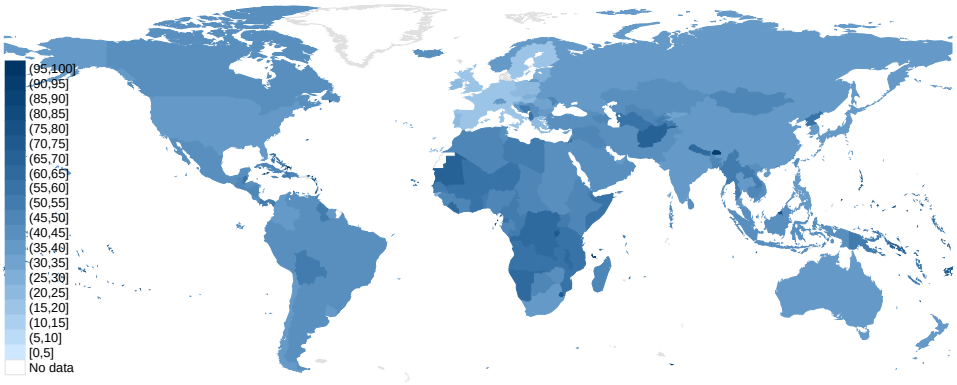
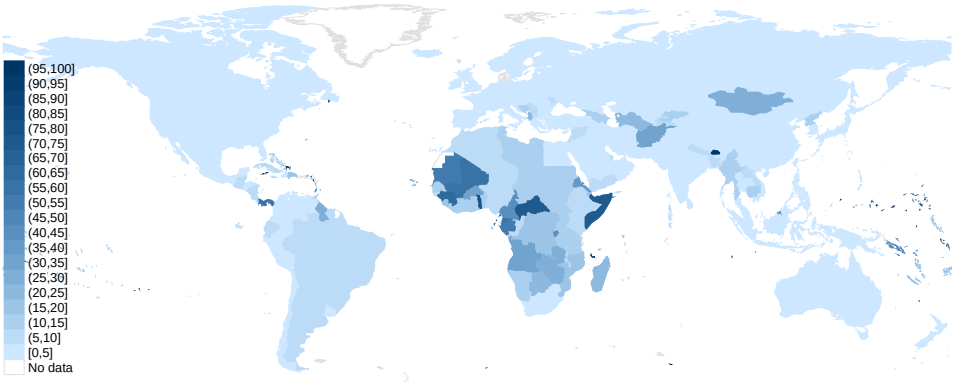


Figure 7 the variance across destinations is much higher. For the 213 Danish export destinations the median share of one-off exports in total export volumes is 8%, the bottom and top deciles are 1.1% and 67.5%, respectively. However, for some export destinations that are either very small and faraway such as Tuvalu and/or haunted by continuous wars and conflicts such as Somalia, to pick some extremes, one-off exports may account for above 70% (Somalia) or even 100% (Tuvalu) of the value of all exports to these destinations, i.e., these are markets that firms would not prioritize for proactive exporting. According to our conceptual model from Section 3,

Figure 7: **The share of one-off exports in total export volume**



and Implication 4, the occurrence of one-off exporting will naturally vary across destinations. For example, fixed export marketing costs, $F_{m,i}$, should be higher for more distant markets and smaller destinations might not justify a given expenditure on market access costs. Hence, smaller and faraway destinations would see more one-off exporting. In addition, political instability and conflicts give rise to potentially large demand and cost fluctuations and may as well impact on market access costs. At the same time, uncertainty concerning true export costs and true demand may be particularly high for less obvious export destinations. This makes a testing-

the-waters approach both on the customer side (passive exporting) and the seller side (proactive exporting) more relevant. Ultimately, the importance of destination market characteristics for one-off exporting is an empirical question. In particular, the literature following Besedes and Prusa (2006a and 2006b) has identified an important link between export duration and destination market characteristics.

To analyze the determinants for one-off exports more systematically, we estimate variants of a simple descriptive model respectively regressing the destination-industry-specific share Ψ_j^d of one-off exports in all export spells and the share Υ_j^d of one-off exports in the total export volume to a given destination within industry j on various destination-specific characteristics.[27]

Destination-specific demand (market size) is operationalized by log destination country GDP (GDP_d). Fixed marketing costs, that conditional on customer base are decisive for whether a market is served proactively or passively (Implication 4), are approximated by log distance ($dist_d$). Obviously, the ratio F_m^d/F_x^d can also be affected through other channels, hence we include dummies for regional trade agreements ($D : rta_d$) and destination country membership in the World Trade Organisation ($D : wto_d$). Furthermore, we control for industry-level heterogeneity by including a full set of industry dummies (D_j).[28] Finally, additional drivers of market access costs and volatility (say shocks that may end otherwise continued proactive export episodes) are modelled through controlling for political stability and violence in a specific destination drawing on the Worldwide Governance Indicator database (see Kaufmann et al., 2010). A higher index value for the variable PS implies a more stable environment.[29]

As Ψ and Υ are proportions between 0 and 1 we estimate parameters with the fractional logit model of Papke and Wooldridge (1996) which is a generalised linear

[27] More formally the industry-destination one-off export spell share is constructed as $\Psi_j^d = \frac{\sum_{s \in S_d \cap S_{re} \cap S_j} 1}{\sum_{s \in S_d \cap S_j} 1}$ with S_j denoting the set of all export spells belonging to industry j. The destination-industry-specific volume share is $\Upsilon_j^d = \frac{\sum_{s \in S_d \cap S_{re} \cap S_j} ex_s}{\sum_{s \in S_d \cap S_j} ex_s}$.

[28] The respective control variables were obtained from the CEPII gravity database and updated for the years 2007 to 2011 drawing on data from the World Bank, the UN, and the WTO. The CEPII database does not contain information on all Danish export destinations, for numerous very small countries GDP figures are missing, such that we can only estimate the model for a cross section of 183 destinations. We collapse our data to one observation per industry and destination yielding a total of 3250 destination-industry-level observations. Accordingly, destination country GDP is averaged over the period 2003-2010. All dummy variables take the value one if they in the period 2003 to 2010 take the value one at least once.

[29] Since country coverage is somewhat smaller in this database – we particularly lack information on a number of micro states – model specifications with the political stability control are only estimated with 3,221 observations.

model with a logit link function Λ and a binomial distribution[30]:

$$\begin{aligned} E(\Psi_j^d \vee \Upsilon_j^d | x_j^d) &= \Lambda\{\alpha_j D_j + \beta \ln GDP_d + \gamma \ln dist_d + \eta D : rta_d \\ &+ \vartheta D : wto_d + \kappa PS_d\}. \end{aligned} \tag{10}$$

Table 3 reports the marginal effects[31] of the above maximum likelihood model and shows that the one-off spell share Ψ and one-off export volume share Υ decrease in market size of the export destination and increase in distance. For instance, a 100% higher GDP implies a 3.6 percentage point lowering of Ψ, and a 100% larger distance implies a 6.4 percentage point increase of Ψ. Furthermore, both the value share and the spell share of one-off exporting are significantly lower for export destinations that share a regional trade agreement or that are part of the WTO. An export destination that shares a regional trade agreement, for example, ceteris paribus receives a 6 percentage points lower proportion of one-off export spells. Furthermore, we see that one-off exports are less important the more politically stable and the less violent an export destination is, i.e., stable environments foster proactive exporting.

Table 3: **Destination determinants of one-off export shares**

	(I) Ψ_j^d	(II) Υ_j^d	(III) Ψ_j^d	(IV) Υ_j^d
$\ln GDP_d$	-0.036 ***	-0.066 ***	-0.036 ***	-0.068 ***
	(0.002)	(0.003)	(0.002)	(0.003)
$\ln distance$	0.064 ***	0.065 ***	0.062 ***	0.069 ***
	(0.007)	(0.010)	(0.007)	(0.010)
$D : rta_d$	-0.060 ***	-0.087 ***	-0.056 ***	-0.069 ***
	(0.014)	(0.017)	(0.014)	(0.017)
$D : wto_d$	-0.056 ***	-0.060 ***	-0.049 ***	-0.050 ***
	(0.015)	(0.017)	(0.015)	(0.016)
PS			-0.012 **	-0.029 ***
			(0.006)	(0.006)
Observations	3250	3250	3221	3221

Notes: Marginal effects reported. Marginal effects for dummy variables calculated for a discrete change from 0 to 1. **, *** Statistically significant at the 5%, and 1% levels, respectively. Robust standard errors in parentheses. All models control for industry fixed effects.

[30] We also estimated the model by OLS, fundamental findings are not altered.

[31] Marginal effects for dummy variables are actually calculated for a discrete change from 0 to 1.

4.2 Firm-level analysis of one-off exports

Based on the classification of an export spell as an one-off event, we can collapse all observed export spells and associated volumes into firm-specific shares of one-off export spells and volumes over the period 2003 to 2010. Accordingly, our final collapsed export-related data consist of one observation per firm. The two continuous measures Ψ_i and Υ_i capture the importance of passive one-off exporting for firm i expressed in relation to the overall number of its export spells and its overall export volume respectively:

$$\Psi_i = \frac{\sum_{s \in S_i \cap S_{re}} 1}{\sum_{s_i \in S_i} 1} \quad , \quad \Upsilon_i = \frac{\sum_{s \in S_i \cap S_{re}} ex_s}{\sum_{s \in S_i} ex_s} \ , \tag{11}$$

with s representing a firm-product-destination-specific export spell, S_{re} the set of all one-off export spells and S_i the set of all export spells belonging to firm i. The volume of a specific export spell is denoted as ex_s.

Results in Table 4 reinforce our descriptives in Section 2. We find that $\frac{1}{n_X}\sum_i \Psi_i = 0.43$, i.e., on average one-off exports make up 43% of all export spells for an export-active firm. Moreover, $\frac{1}{n_X}\sum_i \Upsilon_i = 0.17$, i.e., on average 17% of an export-active firm's overall export volume are accounted for by isolated one-off export episodes. These are striking figures suggesting that passive one-off exporting indeed is an important firm-level phenomenon.[32] To compare the prevalence of

Table 4: **Firm-level one-off and temporary exporting, descriptive statistics**

	Mean	SD	Bottom decile	Median	Top decile
Ψ_i	0.43	0.25	0.18	0.38	0.80
Υ_i	0.17	0.31	0.00	0.02	0.83
$\Omega_i - \Psi_i$	0.35	0.21	0.00	0.34	0.58
$\Theta_i - \Upsilon_i$	0.22	0.31	0.00	0.06	0.82

one-off exports to that of temporary exports as identified by Békés and Muraközy (2012), we also calculate the share of temporary exports in firms' export spells Ω_i and the respective export volume share Θ_i. Naturally, one-off exports are nested in Ω_i and Θ_i. Table 4 reports the respective figures net of one-off exports: $\Omega_i - \Psi_i$

[32] To rule out that these figures are driven by sporadic exports of capital goods, which may be of particular relevance for small exporters, we identify capital goods exports at the 8-digit level of the Combined Nomenclature and disregard them for the construction of Ψ and Υ as a robustness test. When doing so, the mean of Ψ_i is actually raised to 44% and the mean of Υ_i increases to 18%. Furthermore, all findings presented in what follows remain essentially unchanged.

and $\Theta_i - \Upsilon_i$.[33]

On average, temporary export spells excluding one-off export events account for 35% of all export spells for an export-active firm. Accordingly, in terms of prevalence one-off exports on average dominate. Combining one-off export spells with temporary exports on average accounts for about 78% of all export spells of an export-active firm. This figure is similar to the one reported in Békés and Muraközy (2012) based on Hungarian data. In terms of export volume temporary exports net of one-off exports account on average for about 22% of exporters' foreign sales and thus they are roughly on a par with one-off exports.

The surprising prevalence and importance of one-off export events at the firm level clearly warrant additional investigation. In principle, isolated single-month exporting could be the result of proactive exporting being discontinued within the first month of transaction. This could be due to unexpected cost spikes or negative productivity/demand shocks. However, we would expect such shocks for each firm to be evenly distributed across time. Thus, one would not observe a high frequency of spells ending exactly within one month. Our descriptive findings show the opposite, with $\frac{1}{n_X}\sum_i \Psi_i = 0.43$ on average more than 40% of a firm's export spells last only one month.

4.3 Firm-level stylized facts

In the following section, we relate firm-characteristics to one-off, temporary, permanent and non-exporting as suggested by our conceptual model. Implications 1 to 3 suggest that proactive exports would be associated with larger firm size and higher productivity than passive exports. At the same time proactive exports that are temporary are expected to be associated with smaller firm size and lower firm productivity than permanent proactive exports. But what does the data actually say?

We focus on the export volume share, i.e., the extend to which a firm's total exports are generated by one-off export events. As before, we collapse all observed export volumes into firm-specific shares of one-off volumes, Υ_i, over the period 2003 to 2010. Similarly, we calculate the respective volume shares for temporary exports net of one-off exports, $\Theta_i - \Upsilon_i$.

For the following empirical analysis we retrieve value added, full-time equivalent employment and domestic sales information from firm-level business accounts and combine them with the collapsed firm-level export data. To assess the association

[33] $\Omega_i = \frac{\sum_{s\in S_i \cap S_t} 1}{\sum_{s_i \in S_i} 1}$ and $\Theta_i = \frac{\sum_{s\in S_i \cap S_t} ex_s}{\sum_{s\in S_i} ex_s}$ with S_t denoting the set of temporary exports.

of firm characteristics and the intensity with which firms engage in one-off exports, we estimate variants of the following simple descriptive model:

$$\begin{aligned} \ln Y_{i\ 2003} &= \alpha_j + \delta_Y EX_i + \upsilon_Y EX_i \times \Upsilon_i \\ &+ \lambda_Y EX_i \times (\Theta_i - \Upsilon_i) + \epsilon_i, \end{aligned} \tag{12}$$

with $\ln Y_{i\ 2003}$ representing start of sample firm characteristics, namely log productivity and log domestic sales. The dummy variable EX takes the value one if at any time during the sample period the firm has been an exporter. Industry fixed effects α_j with $i \in j$ control for potentially correlated industry-specific unobserved characteristics. The remaining error term ϵ_i is assumed to be iid Recall that all firm- and time-specific observations are collapsed into one observation per firm. This avoids the complexities of time-changing firm-specific shares of one-off and temporary export volumes.

On the basis of the so obtained parameter estimates, we calculate the average predicted percentage differences between exporters and non-exporters with respect to their start of sample productivity and domestic sales. These predicted percentage differences depend on Υ_i as well as Θ_i.

$$\left(\frac{Y_{2003}^{EX=1}}{Y_{2003}^{EX=0}} - 1\right) = \exp\left(\hat{\delta}_Y + \hat{\upsilon}_Y \Upsilon_i + \hat{\lambda}_Y(\Theta_i - \Upsilon_i)\right) - 1$$

Table 5 reports exemplary calculations for the bottom decile, median and top decile of Υ and $\Theta - \Upsilon$. First turning to labor productivity (value added per worker), we find a concise sorting pattern.[34] As expected, exporters in our sample are significantly more productive than non-exporters. However, the exporter productivity premium is strongly associated with the predominant export mode of the firm. Exporters with predominantly permanent exports, i.e., exporters in the bottom decile of Υ and $(\Theta - \Upsilon)$ are 27% more productive than non-exporters. To the extent that the share of one-off exports increases, this productivity premium significantly falls as becomes apparent by moving down Column (I) and by looking at the Wald test comparing the bottom and top deciles of Υ in Table 5. All other things equal, exporters at the top decile of Υ, i.e., firms with the highest proportion of one-off exports, on average are not more productive than the control group of non-exporters. At the same time, when the share of temporary exports net of one-off exports $(\Theta - \Upsilon)$ increases, the exporter productivity premium falls even further: Moving from left to right in the top panel of Table 5 one sees that regardless of the share of

[34] For robustness we have re-estimated Table 5 for extra EU trade only, while enforcing official reporting thresholds on the data. All results are maintained.

Table 5: **Exporters vs. non-exporters depending on one-off and temporary export volume shares, in percent**

$(\Theta_i - \Upsilon_i)$ / Υ_i	Bottom decile	Median	Top decile	$H_0 : Bottom = Top$
	(I)	(II)	(III)	
		Labour productivity		
Bottom decile	26.75***	25.95***	15.69***	F=18.82***
	(4.85)	(4.79)	(4.65)	p=0.00
Median	26.23***	25.43***	15.22***	F=18.84***
	(4.82)	(4.76)	(4.62)	p=0.00
Top decile	5.65	4.97		
	(4.31)	(4.27)		
$H_0 : Bottom = Top$	F=69.09 ***	F=69.40***		
	p=0.00	p=0.00		
	(I)	(II)	(III)	
		Domestic sales		
Bottom Decile	147.85**	141.33**	69.26	F=4.58**
	(68.73)	(66.50)	(49.31)	p=0.03
Median	145.53**	139.07**	67.68	F=4.59**
	(67.95)	(65.75)	(48.81)	p=0.03
Top Decile	63.81	59.50		
	(48.47)	(47.06)		
$H_0 : Bottom = Top$	F=5.07**	F=5.12**		
	p=0.02	p=0.02		

Notes: ***, ** Statistically significant at the 1% and 5% levels, respectively. Standard errors in parentheses. Υ and $(\Theta_i - \Upsilon_i)$ denote the one-off and temporary export volume shares, respectively. The lower right corner cells are left empty, since the top decile shares of Υ_i and $(\Theta_i - \Upsilon_i)$ sum to more than 100%, cf. Table 4.

one-off exports, the exporter premium declines the higher $(\Theta - \Upsilon)$ becomes. Yet, contrary to the top decile of one-off exports, the firms in the top decile of temporary exporting are significantly more productive than non-exporters.

Similar patterns hold with respect to firm size as captured by domestic sales. It is the largest firms that select themselves into predominantly permanent exports, while smaller firms have a higher proportion of passive one-off and interrupted proactive exports. As reported in the bottom panel of Table 5, firms in the bottom decile of Υ and $(\Theta - \Upsilon)$ are about 148% larger than non-exporters, a size advantage that drops to zero percent when moving into the top deciles of Υ and $\Theta - \Upsilon$, respectively. These overall sorting patterns at the firm level are consistent with the sorting patterns derived in Section 3 at the firm-product-destination level. Hence, the potential complications from firms producing and exporting multiple products to several markets with different trade barriers do not overturn the theoretical

findings.

Table 6: **Exporters vs. non-exporters depending on one-off and temporary export volume shares, in percent**

$(\Theta_i - \Upsilon_i)$ / Υ_i	Bottom decile	Median	Top decile	$H_0 : Bottom = Top$
	(I)	(II)	(III)	
	Ackerberg, Caves, Frazer (2015), TFP			
Bottom Decile	10.71 ***	10.73 ***	10.89 ***	F=0.01
	(3.84)	(3.82)	(4.04)	p=0.93
Median	10.56 ***	10.57 ***	10.73 ***	F=0.01
	(3.83)	(3.81)	(4.03)	p=0.93
Top Decile	4.09	4.10		
	(3.85)	(3.84)		
$H_0 : Bottom = Top$	F=10.04 ***	F=10.05***		
	p=0.00	p=0.00		

Notes: ***, ** Statistically significant at the 1% and 5% levels, respectively. Standard errors in parentheses. Υ and $(\Theta_i - \Upsilon_i)$ denote the one-off and temporary export volume shares, respectively. The lower right corner cells are left empty, since the top decile shares of Υ_i and $(\Theta_i - \Upsilon_i)$ sum to more than 100%, cf. Table 4.

Differences in labor productivity and size can be directly associated to the theoretical model in Section 3, where labor is the only factor of production. However, we test for the robustness of the productivity findings by considering capital as an additional production factor. We analyze total factor productivity applying the structural GMM estimator of Ackerberg, Caves and Frazer (2015) drawing on intermediate goods purchases to invert unobserved firm-time-specific productivity and employ the methodology of De Loecker (2007) allowing the productivity process to depend on export status. Accordingly, in this specification firm-specific time variant unobserved productivity shocks are controlled for when estimating firm-level total factor productivity. Table 6 shows the results. Exporting firms are found to be significantly more productive than non-exporters. Furthermore, total factor productivity significantly decreases in the proportion of one-off export volumes, as is confirmed by the Wald tests in Columns (I) and (II). This supports the view that less productive firms select into passive one-off exporting. However, with respect to temporary exporting, there emerges an interesting difference between the labor productivity estimates from the upper panel in Table 5 in the main text and the total factor productivity estimates from the middle panel. After controlling for time variant firm-specific productivity shocks there is no distinguishable productivity difference between exporters in the bottom and top deciles of $(\Theta - \Upsilon)$.

Following the arguments of Békés and Muraközy (2012), unfavorable productivity shocks may generate temporary exporting by ending otherwise continued (proactive) export spells. In line with this reasoning, Table 6 finds that firms with a low proportion of temporary exports (i.e. firms not hit by a negative productivity shock) and firms with a high proportion of temporary exports (i.e. firms hit by a negative productivity shock) are very similar in terms of their baseline productivity. Put differently, since the estimation filters productivity shocks out, there is little difference between temporary and permanent exporters. In contrast, selection of less productive firms into passive one-off exporting – the empirical phenomenon at the center of our analysis – prevails, even when unobserved time variant productivity shocks are controlled for.

5 Flipping the data – one-off trade events and Danish importers

While the analysis of our paper deals with one-off trade events from the exporter perspective of a trade relationship, it would still be informative to learn more about the characteristics of the customer that according to our theoretical model initiates unsolicited one-off export orders. However, to the best of our knowledge, there exist no comprehensive data that simultaneously contain information on detailed monthly transactions as well as information on firms' characteristics at both sides of the exchange. Our data, unfortunately, are no exception.

However, by flipping the data that are available to us, i.e., by looking at Danish firms' imports, we can make some progress. This exercise allows us to characterize what types of firms are on the buyer side of one-off, temporary and permanent events. We apply the same definitions as before to classify import spells. Permanent import spells last for 4 or more years. Temporary import spells are any spells lasting 1, 2 or 3 years. One-off import events are origin country-commodity-specific solitary one-month import activities preceded and followed by 24 months of non-importing.

While in the exporter analysis we looked at a balanced sample of manufacturing firms to focus on true one-off events, we now want to exploit the unbalanced universe of Danish firms. This allows us to capture what types of buyers on the customer side are involved in one-off trade activities, i.e., such events could be overproportionately driven by wholesalers, other non-manufacturing firms, or exiting firms. Overall, we observe 54,907 firms of which 48,637 at some point in time import. Table 7 shows the results. Out of the total of 980,755 import spells that we observe, 40% are one-off events and another 36% are temporary (excluding one-off).

Table 7: **Firm-product-destination import spells by category**

		Total	Percentage out of total spells		
		# spells	One-off	Temporary (excl. one-off)	Permanent
CN 2-digit concorded		980,755	39.73	35.77	24.49
Terminated by firm exit		59,380	39.36	34.36	26.28
Percentage due to firm exit			6.00	5.82	
Industry	Nace rev.2				
Manufacturing	C	257,212	39.55	34.64	25.81
Electr.,water	D+E	2844	38.61	43.88	17.51
Construction	F	12,823	44.37	38.38	17.25
Wholesale, retail	G	546,502	37.55	35.40	27.05
Transport.	H	25,373	51.46	35.27	13.27
Inform., commun.	J	29,650	48.48	37.25	14.27
Finance, insurance	K	7720	40.93	41.98	17.09
Other	L-U	98,631	46.00	39.43	14.57

Notes: Permanent: spells of 4 or more years; Temporary: spells of 3, 2 or 1 years; One-off: an isolated one-month-only export transaction in the center of a 49-month interval. See the main text for details on the spell definitions.

A first insight from these data is that firm exit on the buyer side only accounts for approximately 6% of the discontinued import spells, this applies for one-off as well as for temporary events. Most interestingly, the identification of the industry affiliation of the importers shows that although wholesalers and retailers stand for more than half of all the importing episodes, they are not disproportionately involved in one-off events. If anything, wholesalers and retailers are associated with proportionately fewer one-off events. The import pattern of Danish manufacturing firms (the second most important group of importers in terms of the total number of spells) mirrors the overall pattern of one-off, temporary and permanent spells. Finally, the transportation, and information and communication sectors appear to be slightly overrepresented in one-off import events, however they account for less than 3% of all import spells each. Conceivably, transport-sector firms may act as intermediaries for customers unable to conduct an import transaction themselves – typically smaller or sporadic buyers.

6 Conclusion

The present paper identifies a hitherto unnoted pattern in the data and offers an explanation based on a simple intuition. Foreign customers can approach domestic firms that have chosen not to export. As a result, there will be passive as well as proactive exporting. Using a unique balanced panel of Danish manufacturing

firms combined with detailed monthly export transactions, we find that even with a conservative filtering approach 33% of all observed export spells are in fact isolated single-month one-off export transactions. The remaining spells are either temporary 1-3-year spells (36%) or permanent 4+ year spells (31%). While one-off export events deliver only 0.65% of the total export volume in our panel, they are highly important from a firm perspective. Averaging across export-active firms, one-off export events account for an astonishing 43% of all spells and 17% of total export sales. These are truly striking figures, the more so as the phenomenon is prevalent across the whole manufacturing sector and stable over time.

We argue that the prevalence of one-off exporting is not well explained by existing models and extend standard heterogenous firms trade theory to reconcile theory with the data. In particular, we employ a concept that has been championed in the international business and international marketing literature: the distinction into proactive and passive exporting. In addition to proactive permanent exports and proactive temporary exports (i.e., discontinued once hit by a shock), some unsolicited one-off foreign demand reaches the firm randomly and the firm may choose to export passively. The model suggests a productivity ranking of firms according to their export mode and suggests that destination characteristics that increase fixed market access costs will make passive one-off exporting more likely. Calibrating the model and matching to moments from the data, we find that the fixed costs of exporting associated with proactive exporting (permanent and temporary) must be an order of magnitude 7 to 16 times larger than the fixed costs of passive exporting (one-off).

In terms of empirical findings, our destination-level analysis shows that very distant and small export destinations are more prone to be part in one-off exporting events. Moreover, destinations with no mitigating advantages such as regional or multilateral trade agreements and, as a further detriment, low political stability will be served more often through one-off exports. Furthermore, and in line with insights from our model, we find a clear productivity and size ranking in the data. Exporter productivity and size premia typically decrease the higher a firm's share of passive one-off exports becomes. Our regression analysis indicates that exporters that select into proactive permanent exports as the predominant export mode enjoy a start of sample productivity advantage of about 27% and a start of sample size advantage of 148% in comparison to our control group of non-exporters. Firms that have one-off exporting as their dominant mode of exporting are found to be equally (un)productive and small as non-exporters.

Based on our theoretical and empirical findings, we conclude that a hitherto

largely overlooked passive mode of exporting can explain much of the prevalence of isolated one-off export transactions. We see two promising directions for future research. First, theoretical models of international trade should elaborate further on the buyer side of the export relation. Concepts from international business studies and international marketing might be a rich source of inspiration for such formal extensions. Our paper shows that passive one-off exporting can easily be integrated into the current workhorse model. Second, although the actual export initiation is never recorded in official register microdata, several data sets include some information on the imports of firms. Future research could map the import behavior of firms in more detail, for example, by identifying firm characteristics that are associated with a taste for one-off import relations.

References

Ackerberg, D.A., K. Caves and G. Frazer (2015) 'Identification Properties of Recent Production Function Estimators,' *Econometrica*, 83(6), 2411-2451.

Aeberhardt, R., I. Buono and H. Fadinger (2014) 'Learning, incomplete contracts and export dynamics: Theory and evidence from French firms,' *European Economic Review*, 68, 219-249.

Albornoz, F., H.F. Calvo Pardo, G. Corcos and E. Ornelas (2012) 'Sequential exporting,' *Journal of International Economics*, 88 (1), 17-31.

Alessandria, G., J.P. Kaboski and V. Midrigan (2010) 'Inventories, Lumpy Trade, and Large Devaluations,' *American Economic Review*, 100(5), 2304-39.

Békés, G. and B. Muraközy (2012) 'Temporary trade and heterogeneous firms,' *Journal of International Economics* 87, 232-246.

Bernard, A.B., R. Massari, J.-D. Reyes and D. Taglioni (2014) 'Exporter Dynamics, Firm Size and Growth, and Partial Year Effects,' *NBER Working Paper* No. 19865.

Besedes, T. and T.J. Prusa (2006a) 'Ins, Outs and the duration of trade,' *Canadian Journal of Economics* 39(1), 266-295.

Besedes, T. and T.J. Prusa (2006b) 'Product Differentiation and duration of U.S. import trade,' *Journal of International Economics* 70(2), 339-358.

Besedes, T. and T.J. Prusa (2011) 'The Role of Extensive and Intensive Margins and Export Growth,' *Journal of Development Economics* 96(2), 371-379.

Bilkey, W.J. (1978) 'An Attempted Integration of the Literature on the Export Behavior of firms,' *Journal of International Business Studies* 9 (1), 33-46.

De Loecker, J. (2007) 'Do exports generate higher productivity? Evidence from Slovenia,' *Journal of International Economics* 73(1), 69-98.

Eaton, J., S. Kortum and F. Kramarz (2011) 'An Anatomy of International Trade: Evidence From French Firms,' *Econometrica* 79, 1453-1498.

Gullstrand J. and M. Persson (2015) 'How to Combine High Sunk Costs of Exporting and Low Export Survival,' *Review of World Economics* 151, 23-51.

Hornok, C. and M. Koren (2015) 'Per-Shipment Costs and the Lumpiness of International Trade,' *Review of Economics and Statistics* 97 (2), 525-530.

Johanson, J. and J.-E. Vahlne (1977) 'The Internationalization Process of the Firm - A Model of Knowledge Development and Increasing Foreign Market Commitments,' *Journal of International Business Studies* 8 (1), 23-32.

Kaufmann, D., A. Kraay and M. Mastruzzi (2010) 'The Worldwide Governance Indicators: Methodology and Analytical Issues,' World Bank Policy Research

Working Paper, 5430.

Lawless, M. (2009) 'Firm export dynamics and the geography of trade,' *Journal of International Economics* 77 (2), 245-254.

Leonidou, L.C., C.S. Katsikeas, D. Palihawadana and S. Spyropoulou (2007) 'An analytical review of the factors stimulating smaller firms to export,' *International Marketing Review* 24 (6), 735-770.

Leonidou, L.C., C.S. Katsikeas and D.N. Coudounarisc (2010) 'Five decades of business research into exporting: A bibliographic analysis,' *Journal of International Management* 16 (1), 78-91.

Melitz, M.J. (2003) 'The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity,' *Econometrica* 71, 1695-1725.

Melitz, M.J. and S. Redding (2015) 'New Trade Models, New Welfare Implications,' *American Economic Review* 105 (3), 1105-1146.

Papke, L.E. and J.M. Wooldridge (1996) 'Econometric Methods for Fractional Response Variables with an Application to 401 (K) Plan Participation Rates,' *Journal of Applied Econometrics*, 11, 619-632.

Pierce, J.R. and P.K. Schott (2012) 'Concording US Harmonized System Categories over Time,' *Journal of Official Statistics*, 28 (1), 53-68.

Rauch, J. and J. Watson (2003) 'Starting small in an unfamiliar environment,' *International Journal of Industrial Organization*, 21, 1021-1042.

Schröder, P.J.H. and A. Sørensen (2012) 'Firm Exit, Technological Progress and Trade,' *European Economic Review*, 56 (3), 579-591.

Van Beveren, I., A.B. Bernard and H. Vandenbussche (2012) 'Concording EU Trade And Production Data Over Time,' NBER Working Paper 18604.

Wagner, J. (2016) 'A survey of empirical studies using transaction level data on exports and imports,' *Review of World Economics* 152, 215-225.

Appendix A - Not for Publication

Event shares and volume shares

This appendix derives equations (7) and (8) for the prevalence of passive exporting measured as event shares and volume shares. Take the model from Section 3 in the main text.

Now assume away all exogenous heterogeneity across firms, except for productivity and the realization of the random arrival of unsolicited (one-off) export orders, while keeping heterogeneity across destinations.[35] Moreover, we assume that productivity is Pareto distributed with shape parameter $k > \sigma - 1$. We further assume away time variation in B^d and impose that ρ^d is constant across firms and time.

Consider firm i with productivity φ_i and its supply decisions regarding various markets. Profits in the domestic market read

$$\pi_i(\varphi_i) = B\varphi_i^{\sigma-1} - F,$$

and only firms with

$$\varphi_i > \left(\frac{F}{B}\right)^{\frac{1}{\sigma-1}} \equiv \varphi^*$$

supply the domestic market. The firm may serve export market d through proactive exports which yields a flow profit of

$$\pi_{i,x-pro}^d(\varphi_i) = B^d\varphi_i^{\sigma-1}\left(\tau^d\right)^{1-\sigma} - F_x^d - F_m^d.$$

The expected flow profits from passive exports to market d read

$$\pi_{i,x-pas}^d(\varphi_i) = z^d\left(\rho^d B^d\varphi_i^{\sigma-1}\left(\tau^d\right)^{1-\sigma} - F_x^d\right).$$

The productivity thresholds for passive and proactive exports are defined by

$$\begin{aligned}
\pi_{i,x-pas}^d\left(\varphi_{d,pas}^*\right) &= 0 \Leftrightarrow \varphi_{d,pas}^* = \tau^d\left(\frac{F_x^d}{\rho^d B^d}\right)^{\frac{1}{\sigma-1}} \\
\pi_{i,x-pas}^d\left(\varphi_{d,pro}^*\right) &= \pi_{i,x-pro}^d\left(\varphi_{d,pro}^*\right) \Leftrightarrow \varphi_{d,pro}^* = \tau^d\left(\frac{F_x^d\left(1-z^d\right)+F_m^d}{B^d\left(1-\rho^d z^d\right)}\right)^{\frac{1}{\sigma-1}}.
\end{aligned}$$

We assume that parameters are such that $\varphi_{d,pro}^* > \varphi_{d,pas}^* > \varphi^*$, i.e., that

[35] To be specific, we assume that $F_i^d = F^d, \tau_i^d = \tau^d$, $F_{m,i}^d = F_m^d$, $F_{x,i}^d = F_x^d$, $\rho_i^d = \rho^d$, $z_i^d = z^d$ for all i. We thus assume that $H_i^d(\rho) = H^d(\rho)$ and that $H^d(\rho)$ is degenerate at ρ^d for all i and d.

$\frac{\rho^d}{1-\rho^d z^d}\left(1-z^d+\frac{F_m^d}{F_x^d}\right)>1$ and $\left(\tau^d\right)^{\sigma-1}\frac{F_x^d}{F\rho^d}\frac{B}{B^d}>1$.

Destination-specific measures

We now derive the passive exports share which depends on the ratio of these thresholds but not their actual levels as we assume productivity to be Pareto distributed. Hence, we do not have to solve for the thresholds as their ratios only depend on parameter values. The number of proactive events to market d reads

$$PRO_{events}^d = M\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k},$$

where M is the mass of active firms in the exporting country. The number of passive events reads

$$\begin{aligned} RE_{event}^d &= Mz^d\left[1-\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}-1+\left(\frac{\varphi_{d,pas}^*}{\varphi^*}\right)^{-k}\right] \\ &= Mz^d\left[\left(\frac{\varphi_{d,pas}^*}{\varphi^*}\right)^{-k}-\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}\right]. \end{aligned}$$

Hence, the fraction of export events being passive reads

$$\begin{aligned} \hat{\Psi}^d &\equiv \frac{RE_{event}^d}{RE_{event}^d+PRO_{events}^d}=\frac{Mz^d\left[\left(\frac{\varphi_{d,pas}^*}{\varphi^*}\right)^{-k}-\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}\right]}{Mz^d\left[\left(\frac{\varphi_{d,pas}^*}{\varphi^*}\right)^{-k}-\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}\right]+M\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}} \\ &= \left(1+\frac{\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}}{z^d\left[\left(\frac{\varphi_{d,pas}^*}{\varphi^*}\right)^{-k}-\left(\frac{\varphi_{d,pro}^*}{\varphi^*}\right)^{-k}\right]}\right)^{-1}=\left(1+\frac{1}{z^d\left[\left(\frac{\varphi_{d,pas}^*}{\varphi_{d,pro}^*}\right)^{-k}-1\right]}\right)^{-1} \\ &= \left(1+\frac{1}{z^d}\frac{1}{\left(\frac{\rho^d}{1-\rho^d z^d}\left(1-z^d+\frac{F_m^d}{F_x^d}\right)\right)^{\frac{k}{\sigma-1}}-1}\right)^{-1} \\ &= \left(1+\frac{1}{z^d}\frac{\left(\frac{\rho^d}{1-\rho^d z^d}\left(1-z^d+\frac{F_m^d}{F_x^d}\right)\right)^{-\frac{k}{\sigma-1}}}{1-\left(\frac{\rho^d}{1-\rho^d z^d}\left(1-z^d+\frac{F_m^d}{F_x^d}\right)\right)^{-\frac{k}{\sigma-1}}}\right)^{-1}. \end{aligned}$$

Turning to export volumes, we have that volumes from proactive exports (PRO^d_{vol}) and passive exports (RE^d_{vol}) read

$$\begin{aligned}
PRO^d_{vol} &= M\int_{\varphi^*_{d,pro}}^{\infty} \sigma B^d \varphi^{\sigma-1} \left(\tau^d\right)^{1-\sigma} k\left(\varphi\right)^{-k-1} \left(\varphi^*\right)^k d\varphi \\
&= M\sigma B^d \frac{k}{k-(\sigma-1)} \left(\varphi^*\right)^k \left(\tau^d\right)^{1-\sigma} \left(\varphi^*_{d,pro}\right)^{\sigma-1-k} \\
RE^d_{vol} &= M\int_{\varphi^*_{d,pas}}^{\varphi^*_{d,pro}} z^d \rho^d \sigma B^d \varphi^{\sigma-1} \left(\tau^d\right)^{1-\sigma} k\left(\varphi\right)^{-k-1} \left(\varphi^*\right)^k d\varphi \\
&= M\sigma B^d \frac{k}{k-(\sigma-1)} \left(\varphi^*\right)^k z^d \rho^d \left(\tau^d\right)^{1-\sigma} \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right).
\end{aligned}$$

Accordingly, the volume share becomes

$$\begin{aligned}
\hat{\Upsilon}^d &\equiv \frac{RE^d_{vol}}{RE^d_{vol}+PRO^d_{vol}} = \\
&= \frac{M\sigma B^d \frac{k}{k-(\sigma-1)} \left(\varphi^*\right)^k z^d \rho^d \left(\tau^d\right)^{1-\sigma} \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right)}{M\sigma B^d \frac{k}{k-(\sigma-1)} \left(\varphi^*\right)^k \left(\tau^d\right)^{1-\sigma} \left[z^d \rho^d \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right) + \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right]} \\
&= \frac{z^d \rho^d \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right)}{z^d \rho^d \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right) + \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}} \\
&= \left(1 + \frac{\left(\varphi^*_{d,pro}\right)^{\sigma-1-k}}{z^d \rho^d \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k}\right)}\right)^{-1} \\
&= \left(1 + \frac{1}{z^d \rho^d} \frac{1}{\left(\frac{\varphi^*_{d,pas}}{\varphi^*_{d,pro}}\right)^{\sigma-1-k} - 1}\right)^{-1} \\
&= \left(1 + \frac{1}{z^d \rho^d} \frac{1}{\left(\frac{\rho^d}{1-\rho^d z^d}\left(1 - z^d + \frac{F^d_m}{F^d_x}\right)\right)^{\frac{k}{\sigma-1}-1} - 1}\right)^{-1} \\
&= \left(1 + \frac{1}{z^d \rho^d} \frac{\left(\frac{\rho^d}{1-\rho^d z^d}\left(1 - z^d + \frac{F^d_m}{F^d_x}\right)\right)^{1-\frac{k}{\sigma-1}}}{1 - \left(\frac{\rho^d}{1-\rho^d z^d}\left(1 - z^d + \frac{F^d_m}{F^d_x}\right)\right)^{1-\frac{k}{\sigma-1}}}\right)^{-1}.
\end{aligned}$$

Implication 4 follows easily from taking partial derivatives of $\hat{\Psi}^d$ and $\hat{\Upsilon}^d$ with respect to ρ^d, z^d, and $\frac{F^d_m}{F^d_x}$.

Aggregate measures

The corresponding aggregate measures (used in the calibration exercise) read

$$\hat{\Psi} \equiv \frac{RE_{event}}{RE_{event} + PRO_{events}} = \frac{M \sum_d z^d \left[\left(\frac{\varphi^*_{d,pas}}{\varphi^*} \right)^{-k} - \left(\frac{\varphi^*_{d,pro}}{\varphi^*} \right)^{-k} \right]}{M \sum_d z^d \left[\left(\frac{\varphi^*_{d,pas}}{\varphi^*} \right)^{-k} - \left(\frac{\varphi^*_{d,pro}}{\varphi^*} \right)^{-k} \right] + M \sum_d \left(\frac{\varphi^*_{d,pro}}{\varphi^*} \right)^{-k}}$$

and

$$\begin{aligned} \hat{\Upsilon} &\equiv \frac{RE_{vol}}{RE_{vol} + PRO_{vol}} \\ &= \frac{M \sum_d \sigma B^d \frac{k}{k-(\sigma-1)} (\varphi^*)^k z^d \rho^d \left(\tau^d\right)^{1-\sigma} \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k} \right)}{M \frac{k\sigma}{k-(\sigma-1)} (\varphi^*)^k \sum_d B^d \left(\tau^d\right)^{1-\sigma} \left(z^d \rho^d \left(\left(\varphi^*_{d,pas}\right)^{\sigma-1-k} - \left(\varphi^*_{d,pro}\right)^{\sigma-1-k} \right) + \left(\varphi^*_{d,pro}\right)^{\sigma-1-k} \right)} \end{aligned}$$

In the calibration analysis we further assume that export destinations are identical, i.e., $B^d = B_0, z^d = z, \rho^d = \rho, F_m^d = F_m, \tau^d = \tau$, and $F_x^d = F_x$ for all d. Accordingly, the aggregate event share and volume share become

$$\hat{\Psi} = \frac{z \left[\left(\frac{\varphi^*_{pas}}{\varphi^*} \right)^{-k} - \left(\frac{\varphi^*_{pro}}{\varphi^*} \right)^{-k} \right]}{z \left[\left(\frac{\varphi^*_{pas}}{\varphi^*} \right)^{-k} - \left(\frac{\varphi^*_{pro}}{\varphi^*} \right)^{-k} \right] + \left(\frac{\varphi^*_{pro}}{\varphi^*} \right)^{-k}} = \left(1 + \frac{1}{z} \frac{\left(\frac{\rho}{1-\rho z} \left(1 - z + \frac{F_m}{F_x} \right) \right)^{-\frac{k}{\sigma-1}}}{1 - \left(\frac{\rho}{1-\rho z} \left(1 - z + \frac{F_m}{F_x} \right) \right)^{-\frac{k}{\sigma-1}}} \right)^{-1}$$

and

$$\begin{aligned} \hat{\Upsilon} &= \frac{z\rho \left(\left(\varphi^*_{pas}\right)^{\sigma-1-k} - \left(\varphi^*_{pro}\right)^{\sigma-1-k} \right)}{z\rho \left(\left(\varphi^*_{pas}\right)^{\sigma-1-k} - \left(\varphi^*_{pro}\right)^{\sigma-1-k} \right) + \left(\varphi^*_{pro}\right)^{\sigma-1-k}} \\ &= \left(1 + \frac{1}{z\rho} \frac{\left(\frac{\rho}{1-\rho z} \left(1 - z + \frac{F_m}{F_x} \right) \right)^{1-\frac{k}{\sigma-1}}}{1 - \left(\frac{\rho}{1-\rho z} \left(1 - z + \frac{F_m}{F_x} \right) \right)^{1-\frac{k}{\sigma-1}}} \right)^{-1}. \end{aligned}$$